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ELGIN OBSERVATORY.

By W. W. PAYNE.

[*This paper, aside from its intrinsic value, will have special interest because of its authorship for those who have been acquainted with this magazine for eighteen years or more. Those who have become readers of it more recently will be interested to learn that the writer of this paper is the person who founded the magazine, "Popular Astronomy," and who carried the responsibility of its management through the first eighteen volumes. We have in these pages an account of some of the things he has accomplished since he retired from the editorship of "Popular Astronomy," the directorship of Goodsell Observatory, and a professorship of mathematics and astronomy in Carleton College in 1908. At the time of his promotion from the position of Director of the Elgin Observatory to that of Director Emeritus, on November 1, the editors requested him to prepare an account of the founding and development of the Elgin Observatory. This request was promptly and graciously acceded to by him. We are greatly pleased to have this contribution from him in his ninetieth year as the opening paper of Volume XXXV of his magazine.*—EDITORS.]

In the year 1909, the month of May, the Elgin National Watch Company employed me to assist in planning and building an astronomical Observatory, for the purpose of getting, keeping, and signaling to the Watch Factory correct Central Standard Time. The use of such time continuously is much needed, in testing and regulating the thousands of watches that are made daily at the Factory.

To build an astronomical Observatory, the Watch Company needed someone of experience in astronomical work, to assist in choosing a proper site, to approve details of the building, and to secure needed astronomical instruments for its equipment. After conference with the General Superintendent, George E. Hunter, at the time above mentioned, I was employed for one year to give this desired assistance. Mr. George Hunter, an architect, father of Supt. Hunter, was given the task of making the plan for the new Observatory, and it was made my duty to report to him.

The choice of a proper place for the Observatory was soon made. It was located a short distance from the Factory, on high ground of deep, gravel formation, the very best for bases for the piers for the Telescope

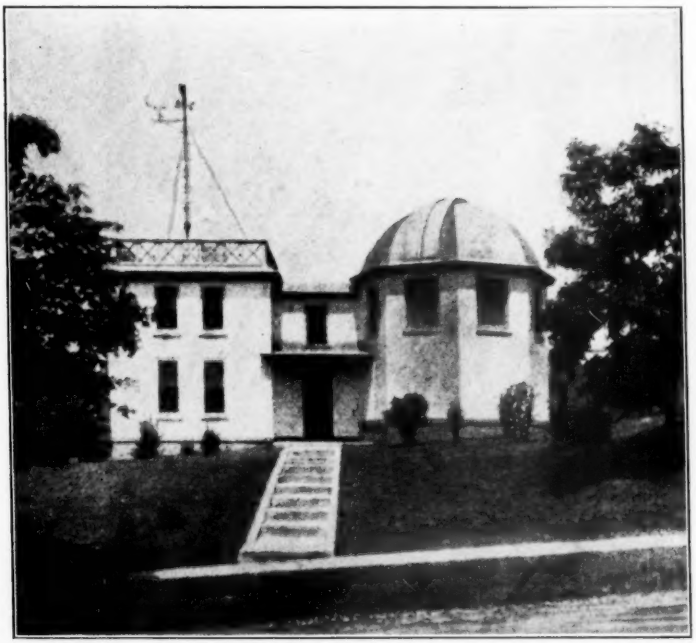
and for the astronomical clocks. The elevation of the site above the Fox river is 84.85 feet; above mean sea level it is 803.33 feet. This latter value was obtained by the city engineer, from a Government bench mark, in the city, to the zero point in the Barometer of the Observatory.

Before I came to Elgin the Watch Company had purchased and had in possession a three-inch Transit instrument by Warner and Swasey, Cleveland, O., and two fine astronomical clocks of the Riefler make in Germany. To test the site of the new Observatory still further, it was thought best to build a temporary house there, mount the Transit instrument in it and take star observations. After this was done two things occurred worthy of notice. One was the finding of the difference between the astronomical and the magnetic meridians. That was found to be about four degrees. The other was the occurrence of a very distinct earthquake that shook the Transit instrument visibly. This shock took place on Wednesday morning at 8:45, May 26, 1909.

Star observations in this temporary house were continued favorably, while the building of the new Observatory, near by, was going on. The latitude of the place was found easily; but to get its longitude would require telegraphic signals from Washington, or from some established Observatory with which time signals could be exchanged. After a thorough study of the condition of the Transit instrument, it was decided to secure the aid of Madison Observatory and the Postal Telegraph Co. for the longitude work desired. It took several weeks to complete all the details of it, in which Professor Comstock of Madison Observatory and the officers of the Postal Co. cordially and efficiently co-operated. Four nights of observation of nineteen stars, at Madison and Elgin, with exchange of telegraphic time signals, each night, were used in this part of the work. The nights of observation were September 23, 24, 25, and October 1, 1909. The instruments used at each place were Transits with object glasses three inches in diameter. The observers were Professors Comstock and Payne. The work of reducing the observations of the same stars, made at the different places was done independently by the persons named above. A careful comparison of the results obtained was made at Madison a few days later. The difference in longitude between Elgin and Madison found by Professor Comstock was $4^m\ 32^s.21$. The result of the Elgin observations was $4^m\ 32^s.22$. The result adopted was $4^m\ 32^s.21$, because in the Madison work, for the four nights, the star results were in better agreement than were those made at Elgin. The longitude of Elgin is that much, in time, east of Madison. The position of the 3-inch Transit Instrument in Madison is 0.21 of a second, in time, east of the position of the Meridian Circle of the Observatory; so this small change was needed to connect our result with that of Madison Observatory, as published in the *American Ephemeris* for the year 1909. The position of the Elgin Observatory was found to be, in latitude 44° 1′ north; in longitude $5^h\ 53^m\ 5^s.30$ west from Greenwich. But, as true Central Standard Time was

wanted at the Elgin Observatory, a change from the local time was made to that kind of time. That made the time of the daily Radio time signals from Washington, at noon there, one hour early at the Elgin Observatory.

While this work was going on and for some time longer the new Observatory building was being constructed, the details of which were receiving careful attention by all interested. For example, it was decided that the octagonal part of the building, which was to contain the even temperature room for the standard, astronomical clocks, should



Elgin Observatory of the Elgin National Watch Company.

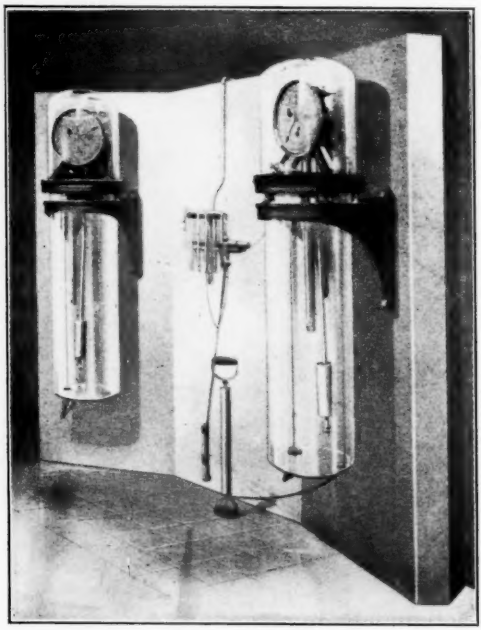
be made of four-inch hollow tile, laid in cement, four courses in thickness, separated from one another by tarred paper to prevent moisture and quick changes of temperature from outside.

The work of completing the Observatory building, the securing of the astronomical and the meteorological instruments and properly mounting them consumed more than one year. During this time, Frank D. Urie, who had done special work in astronomy, at the Detroit Observatory of Michigan University, in Ann Arbor, was appointed assistant to the Director of the Elgin Observatory. Among his duties were the important tasks of oversight of all the instruments and the making

of regular star observations for time. The reduction of these observations to secure the errors and the rates of the clocks from them, and to make needed adjustments of them were to be done by the Director.

In describing the Observatory building and the instruments, in detail, we wish to do it fully enough so that those who have not had experience in this kind of work may be aided, although it may seem to some astronomers to be needlessly full.

The building is unique in form, substantial in structure, attractive in appearance and is fire proof, in all essential parts for the protection

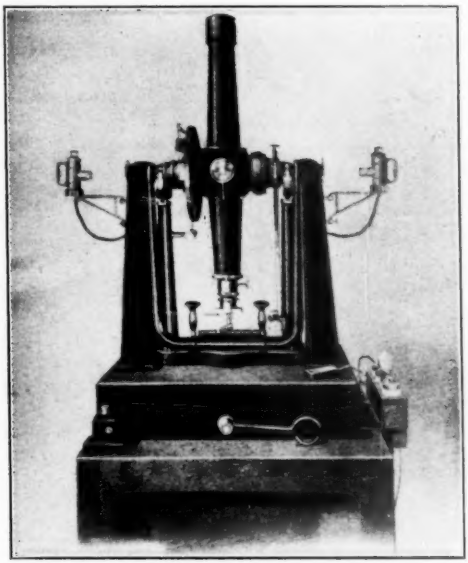


Riefler Astronomical Clocks and Thermoregulator in Constant Temperature Room.

of the instruments. The walls outside are smooth in cement finish and painted white. The roof, cornice, and dome are painted yellow. The dome is nearly a hemisphere in form, with an opening in the meridian three feet wide. It is covered by two steel shutters of about a half ton in weight; yet they are opened and closed so easily that a boy six years old has done it.

The east part of the building has the clock room below and the Transit room above. In the clock room are placed the sidereal and the mean time Riefler clocks mounted on a pier independent of the building. These precision, high grade, self-winding clocks are in air-tight

glass cases, which contain barometers, thermometers and hygrometers to measure the pressure, the temperature, and the moisture of the air inside the clock cases; for the motion of the pendulums is and must be controlled by these conditions to secure a steady rate for the clocks to keep correct time. The temperature of this clock room is kpt at 81 degrees quite steadily by the aid of a thermoregulator and a pair of Electro Magnetic Switches and 57 electric lights. The Thermoregulator controls a current of electricity that puts on and off 18 lights, as needed, to correct the small changes in temperature in the air of the room so that the same may not vary, at any time more than one tenth of a

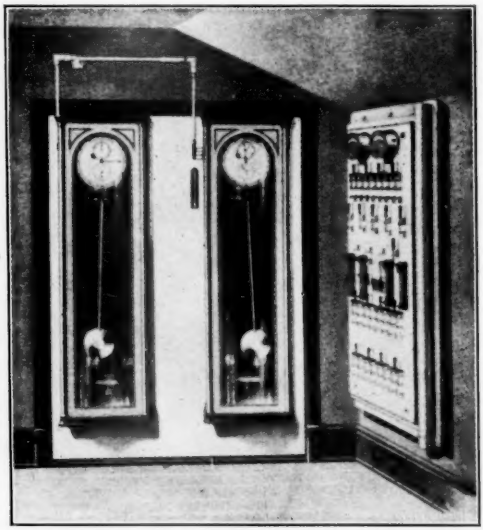


The Transit Instrument.

degree whatever may be the temperature outside. In the past the extreme heat, at one time, was 105 degrees; at another time, the temperature fell to 20 degrees below zero. During such severe tests the clock room remained quite steadily at 81 degrees.

The room above in this part of the building has the Transit Instrument with a three-inch object glass, made by Warner and Swasey of Cleveland, Ohio, at a cost of $1,000. In testing it thoroughly, it was found defective. Machine experts from the Factory were called to examine the pivots and the V's of the mounting. It was soon found that the pivots were unequal frustrums of cones, instead of being equal cylinders, and that the V's were unequal and not right angled as they should be. These errors were corrected, after many hours of work,

with tools made for this special purpose. The final measurement of the pivots showed that they varied in size only one two-thousandth of an inch. No further trouble was experienced in observation. The Transit room also contained a Level Tester, by which the observer could know the error of the observed time, by the change of one division of the level during the time of observation. It was found generally to be about one-tenth of a second of time. This Level Tester was made by the Gaertner Scientific Corporation of Chicago, at a cost of $75. This instrument and the Personal Equation Machine are not shown in the accompanying cuts.



Riefler Astronomical Clocks and Switch Board.

The small room above between the east and west parts of the building contains two Rifler Clocks and Switch Board shown in cut herewith given. These clocks are hung on an independent, cement pier and have dust-tight, wooden cases, with pendulums adapted to open air and small changes of temperature.

When these clocks were put in place, near to each other, on the same pier, it was thought to be a good time to determine the question, whether or not, they would influence one another in any way. Both were set together on the same kind of time, and allowed to run, undisturbed, for several days. The result of this apparently careful test seemed to indicate that the clocks were influencing one another; for there was not any variation of time between them for the entire period. Later these clocks were set, one on star time and the other on standard

time, as intended for use in the Observatory when purchased. Then they did very well, as compared with the precision clocks, in the temperature room which are hung, at an angle, on the same pier.

There is also a Chronograph made by Warner & Swasey, Cleveland, Ohio. It is a very useful instrument for clock comparisons and for making the records of star observations. Also by it fine clocks may be tested, whether in beat or not, more exactly than by the eye and

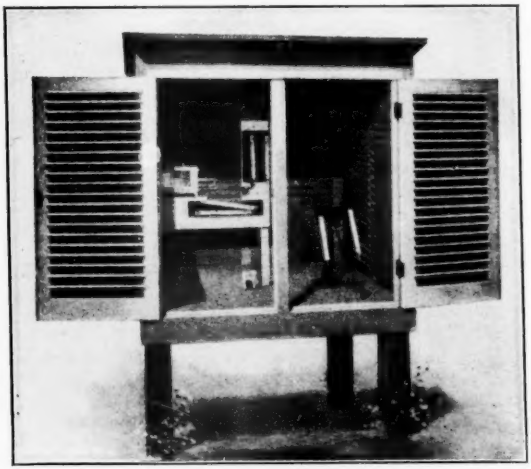
Mark House.

ear method, as formerly used. It is a surprisingly interesting fact, that Mr. Urie of the Elgin Observatory has been able to show, on the chronograph, that the Government clock, at Panama, was out of beat, by aid of the Radio, with other connected, electrical apparatus.

The Personal Equation Machine, made by M. E. Kahler of Washington, D. C., is one of the very useful instruments of the Observatory in getting exact star observations. It is an important fact, that every experienced observer knows, that he has a personal equation, that is

liable to change somewhat, on account of his variable physical condition. Hence it is necessary that his personal equation should be tested at the time star observations are made, if the most accurate results in time are to be secured.

The Meridian Mark is placed in a building, one hundred feet north of the Observatory, and is shown in the accompanying cut. The Mark is made like the apparent star in the Personal Equation Machine. It consists of a thin plate of metal, with a smooth round hole through it, one three-thousandths of an inch in diameter. Behind this hole is placed an electric light to shine through it, to form the apparent star desired. In front of this apparent star, at its focal length, is placed a three-inch object glass. When the Transit Instrument in the Observatory is turned



Thermometer Cage.

into line with the object glass and the apparent star in the meridian, a fine star of the second magnitude is seen in the Transit Instrument; at once showing the observer whether his telescope is in the meridian or not; which he wishes to know before the work of star observation begins.

The Observatory has a complete set of meteorological instruments, except those for recording the tremors of earthquakes. A cut shows the thermometer cage which is placed fifteen feet north of the Observatory building. This distance is needed to prevent the heat of the building from disturbing the temperature of the thermometers in it. The cage is painted white so that sunlight may not disturb the instruments. Any other color would influence them. There are five thermometers shown in the cut, of the best quality of the Green make, tested for uniform calibration throughout. The two placed nearly

horizontal are the self-recording, maximum and minimum thermometers. These are set daily, at true temperature, at a given time, and they then give the highest, the lowest and the mean temperature during the next twenty-four hours. The two thermometers at the right are so mounted that the dry bulb of one and the wet bulb of the other, may be used to find their difference in temperature, by which the amount of moisture in the atmosphere may be determined. When the per cent in amount nears one hundred, rain or snow is probable, if the barometer reading is also favorable. This instrument is named the Psychrometer. The other thermometer is used for ready test comparisons of other thermometers asked by persons outside.

On the roof of the building are seen dimly, the wind vane, the anemometer, the rain gauge, and the sunshine instrument. The anemometer measures the wind velocity; the rain gauge, by the aid of tipping buckets, measures the rainfall to the hundredth of an inch; and the sunshine instrument, by the use of air and mercury in glass tubes, makes a record of sunshine that is steady or that which is interrupted by clouds. All these instruments have electrical connection with a Quadruplex Recorder in the office of the Director in the room below. The clock, in this Recorder, runs a prepared paper sheet, on a cylinder, on which is recorded, in time, electrically and independently the wind velocity, wind direction, the sunshine and the rainfall.

When it was known to the officers, at the head of the Department of Agriculture in Washington and Springfield that the Elgin Observatory was prepared to make meteorological observations, they requested that our daily observations be sent to them regularly. This we agreed to do, provided a government officer would examine our meteorological instruments regularly, as is done for all Government offices. By this examination and other important aid to the service freely given by these officers, our observations have been spoken of as first class for co-operative observers.

The wiring of the Observatory building for the service needed for all the instruments is very complete and easily handled through a fine Switch Board, shown in the cut of the upper clock room. The electric wires connecting the Observatory with the Factory, for the constant time signals, and for light and telephone service are laid under ground and always have given most reliable service.

The time of the Observatory is kept usually within an error of one-fifth of a second, and is sent, in seconds signals, to all rooms in the Watch Factory needing correct time. These time signals are also sent to the chief business office of the Watch Factory in Chicago, and from thence to the Drake Hotel for broadcasting daily except on Sundays. The fine watches made at the Elgin Factory are regulated so thoroughly by the Observatory time that when they are tested at Washington, D. C., for Government use, year after year, they stand these severe tests, which is an honor rarely given to other American watches.

In conclusion I wish to say, that the Elgin National Watch Company, at the time of my retirement, gave me the title of Director Emeritus of the Observatory, with full pay for life; the greatest honor I have received in all my life. Frank D. Urie is now Director of the Elgin Observatory.

THE OCCULTATION OF SATURN 1927 JANUARY 28.

By WILLIAM F. RIGGE.

The occultation of Saturn on next January 28 is the first occultation of this planet that will be visible in the United States since 1916 August 25. The coming occultation, like the preceding one, will occur in the morning, but under more favorable conditions, the time not being quite so early, and the moon not so near the sun, nor so low in the sky. The two annexed maps will probably give all the information desirable for the successful observation of this rare event.

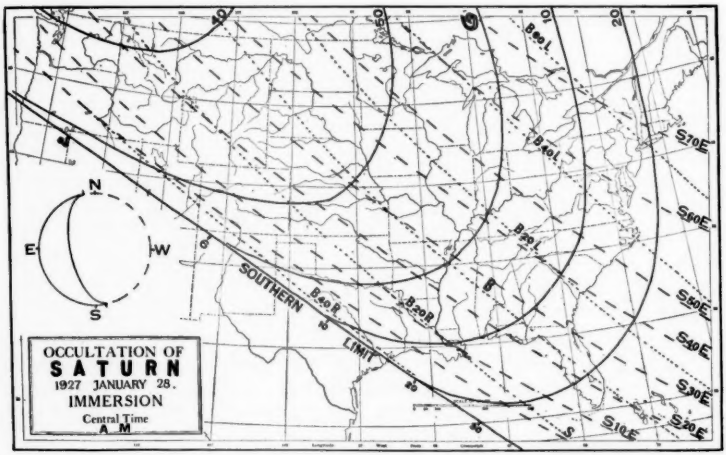


FIGURE 1.

Figure 1 has been drawn for the immersion, that is, for the moment that the planet disappears behind the moon. The full-line curves marked with a large 6 and the numbers 40, 50, 10, 20, give the Central Times for the places at which the immersion will occur at 6 o'clock A. M. and at ten-minute intervals before and after. By measurement tenths of their distances apart, that is, single minutes of time, may be readily found for intervening places. In like manner Figure 2 gives

these times for the reappearance of the planet from behind the moon, or its emersion, in ten-minute intervals before and after 7 A. M.

The Southern Limit line marks the boundary, west and south of which the occultation will not be observable. The numbers on it indicate the times of the grazing contacts from 5:55 to 6:30 A. M.

The dashed lines marked from S to S 70 E in Figure 1 and from S 50 W to N 70 W in Figure 2 show the position angles on the moon's disk as measured from its north and south points, at which Saturn will disappear and reappear. Similarly the dotted curves marked from

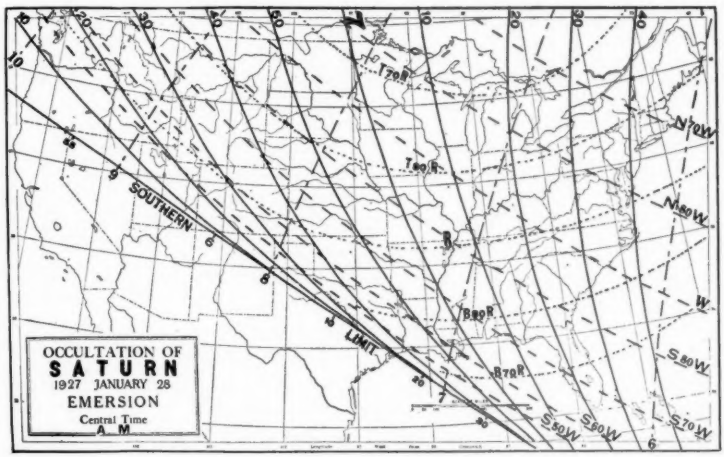


FIGURE 2.

B 40 R to B 60 L and from B 70 R to T 70 R, indicate the position angles as measured from the top T or bottom B towards the right R or left L. While a knowledge of these position angles is really not necessary at the immersion, it is very essential at the emersion, if accurate observation is contemplated. When the telescope is equatorially mounted and provided with a position micrometer, the first system is used, but when it lacks both these advantages, the second is the only one that can be employed, and then these position angles can only be estimated by the eye.

The insert in Figure 1 shows the shape of the moon, 24.7 or —4.8 days old, about 62° away from the sun. The cardinal points N, S, E, W, are given, N being nearest the north celestial pole. It may be of great service to know that the north end of the terminator, or the north cusp or horn of the moon, is 11°.6 east of its north point, so that the position angles in the first system may be measured from it, or even estimated.

Finally the dot-and-dash lines in Figure 2 marked 6, 7, 8, 9, 10, at the bottom, show the places at which the sun will rise at 6, 7, 8, 9, 10,

o'clock central time. From these it is seen that for the Atlantic States the immersion will occur very near the time of sunrise, and the emersion about an hour after it. The western states, however, will not be inconvenienced by the twilight or daylight, although the hours for them may be somewhat early. It may also be necessary to remark that as Saturn is a planet, its immersion and emersion will be gradual, and not instantaneous like those of a star. The stellar magnitude of Saturn will be 0.7.

MORNING AND EVENING STARS FOR 1927.

By FREDERIC R. HONEY.

At an early stage of his study of Astronomy it is desirable that the student should become familiar with the relative positions of the sun and planets for the current year. With the aid of the *Nautical Almanac* it is a simple exercise to make a plot of the planets' orbits, and of their positions. The drawing should be made on a large scale; and the accuracy of the plot may be tested by an examination of the relative positions of the earth and planets at the dates of conjunctions with the sun; and also of the conjunctions of the planets, and with the moon, if the orbit of the latter be drawn to a much larger scale than that of the original plot. There are details which a graphic representation of the elements of the solar system exhibits which might otherwise escape notice. The student is recommended to discover how far the plot is available in the verification of the phenomena of planetary configurations given on pages 672 and 673 of the *Nautical Almanac*.

The continuity of the solar system is shown by plots drawn to different scales. The positions of planets outside the orbit of Mars are given for the first and last days of the year; and, if the plots be compared, the student will see the positions in the heavens of all the planets as seen from the earth. The direction in which the pole is seen is indicated as a point of reference to assist the observer in the determination of the region in which to look for a planet. The arrow is parallel to the projection of the earth's axis on the plane of the ecliptic.

The positions of the earth, Mars, and Venus are shown for the first day of each month; and of Mercury at intervals of eleven days. Since Mercury makes more than four revolutions during the year, in order to avoid confusion in the drawing, the dates are attached for the first revolution only. The dates which should be written for the same position of the planet are arranged in four groups as follows: Jan. 1, March 30, June 26, and Sept. 22; Jan. 23, April 21, July 18, and Oct. 14; Feb. 14, May 13, Aug. 9, and Nov. 5; March 8, June 4, Aug. 31, and Nov. 27.

The earth rotates in the direction of the arrows (see position for Jan. 1), and the observer, before passing from the shadow to the illuminated surface, that is before sunrise, will see that Mercury rises before the sun, and is a morning star; and that after passing from the illuminated to the shadow arc, that is after sunset, he will see that Venus and Mars set after the sun, and are evening stars.

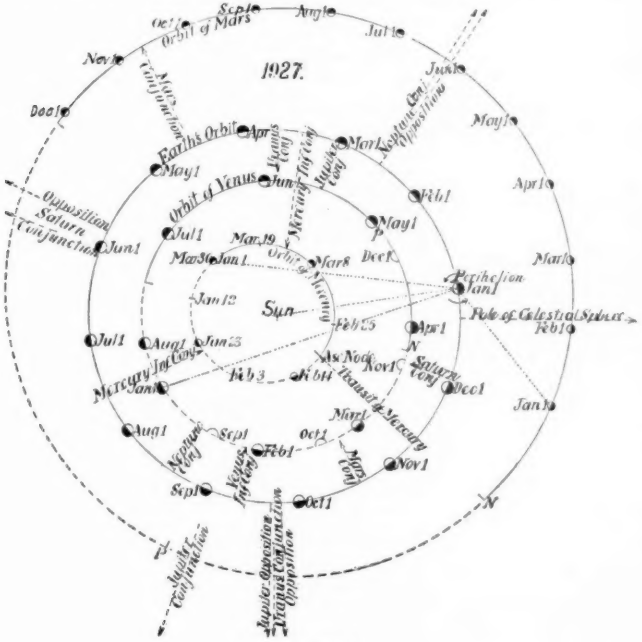


FIGURE 1.

By rotating the plot into a position where the earth is between the reader and the sun, it will be noted that planets which are on the right are morning stars; while those on the left are evening stars; and by inspection of the plot the morning and evening stars for any day of the year may be determined.

The following are examples showing how the plot may be used for one revolution of Mercury which, on account of its position relative to the earth, is apparently very near the sun on Jan. 1.

Jan. $28^d\ 14^h$. In superior conjunction. A straight line drawn through the earth and Mercury should pass through the sun. After this date Mercury is an evening star.

Feb. $25^d\ 15^h$. "Great Elongation"; but, since the planet is near perihelion, the elongation is not as great as is shown later in the year when the planet is farther from the sun.

March $3^d\ 18^h$. "Stationary." The earth and Mercury are moving in the same general direction, but at different velocities. An illustration of how two bodies, moving at different velocities, may be apparently stationary to an observer on either.

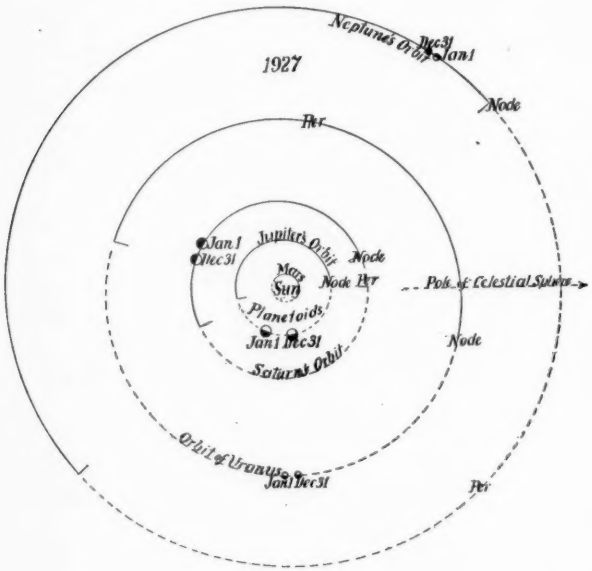


FIGURE 2.

March $13^d\ 15^h$. "Inferior Conjunction." The planet passes between the earth and the sun. After this date Mercury is again morning star, and will be seen to good advantage before sunrise on

April $10^d\ 8^h$. "Great Elongation," when the planet is very near aphelion. Noting the position of the earth, it will be seen that Mercury's radius vector subtends a larger angle at this date as compared with that of Feb. 25.

Similarly the phenomena of the planet for all the revolutions may be shown in the plot.

Venus, on Jan. 1, is apparently very near the sun and is evening star. As the planet gradually approaches the earth it becomes brighter until

Aug. $5^d\ 15^h$. "Greatest brilliancy," showing the beautiful crescent phase.

Sept. $10^d\ 18^h$. "Inferior Conjunction." After this date, when the planet passes between the earth and the sun, Venus becomes morning star, and again exhibits

Oct. $17^d\ 20^h$ "Greatest brilliancy"; and will be morning star for the remainder of the year. On account of the great variations in the dis-

tances between the earth and Venus during the year, the changes in the apparent diameter of the planet are very great. It must be remembered however that, while the diameter reaches its maximum at inferior conjunction, the area of the visible crescent immediately before and after the date of conjunction is very narrow, and the greatest brilliancy occurs on each side of inferior conjunction where the apparent diameter is diminished, and when a larger part of the illuminated area is visible.

Rules for determining Morning and Evening Stars.

The planets Mercury and Venus. Morning star after inferior conjunction, and before superior conjunction. Evening star after superior conjunction, and before inferior conjunction.

Planets beyond the earth's orbit. Before conjunction Evening Star; after conjunction Morning Star.

Dates of Conjunctions and Oppositions.

Mercury. Sup. Conjunctions. Jan. 28, May 20, Sept. 2; Inf. Conjunctions. March 13, July 20, Nov. 10 (transit).

Venus. Inf. Conjunction Sept. 10. Mars, Conjunction Oct. 21.

Jupiter, Conjunction March 1; Opposition Sept. 22.

Saturn, Opposition May 26; Conjunction Dec. 3.

Uranus, Conjunction March 21; Opposition Sept. 25.

Neptune, Opposition Feb. 15; Conjunction Aug. 20.

Trinity College, Hartford, Connecticut.

READING THE TIME FROM THE STARS.

By L. M. BERKELEY.

Various methods have been given for reading off the time from the positions of the stars. The following (which is believed to be new) is very simple and very easy to remember.

Every one is familiar with the North Star and with the "Dipper." Draw a line from the North Star to the star at the extremity of the handle of the "Dipper." At about the middle of this line and on the side away from the bowl of the "Dipper" is a star of the second magnitude called Kochab (*Beta Ursae Minoris*). It is the nearest bright star to the North Star, and is one of the stars of the "Little Dipper."

Consider the northern sky as a clock face, with the North Star at the center, and with the circumference divided into degrees, numbered from the top westwardly (counterclockwise) around the circle from 0° to 360°. Consider the line from the North Star to Kochab as a hand on this clock face. Then, since the stars move in the same direction as the sun, the motion of this clock hand will be in the direction contrary to the hands of an ordinary clock; and the hand will make one revolution in 24 hours.

This moving hand will trace out an angle which may be called the position angle, and may be measured from the top of the above dial westerly around the circle from 0° to 360°. Thus if our clock hand is pointing exactly west from the North Star, the position angle will be 90° ; if exactly east, 270° ; etc.

It is well known that the stars gain on the sun $3^m\ 56^s.555$ per day. In degrees this is 0°.9856, or nearly 1°. It may also be written (1 — 14/1000)°.

At midnight ushering in May 4, that is at the first moment of May 4, Kochab is nearly at upper culmination, which means that our position angle as above described is then zero. At midnight constituting the first moment of May 5, the position angle has increased, and is 1°. At midnight forming the beginning of May 6, the position angle is 2° ; and so on, the position angle for any date corresponding to the number of days from May 4 up to that date.

Now, as an example, let us take August 9 as the date. This date is 3 months and 5 days after May 4, *i. e.* 95 days, reckoning 30 days to the month. Hence the position angle of our clock hand at the first instant of August 9 is 95°. If then, at some time after midnight on this date, an observer notes that the position angle of the clock hand is 65°, what is the hour? Since the position angle at midnight is 95°, and since the observed position angle, coming some time later, is 65°, it is obvious that the hand of our star clock has, since midnight, moved from 95° around to 360°, and then on to 65°, making 330° in all. Hence the time is 22^h after midnight, or 10 o'clock P. M.

An accurate calculation gives $21^h\ 59^m\ 11^s.5$ instead of 22^h, so that the error is less than one minute.

As another example, let us suppose that on December 6 the position angle of our clock hand is 247°. What is the time?

From May 4 to December 6 is 7 months and 2 days, or 212 days. Hence the position angle of the clock hand at the first instant of December 6 is 212°. The observed position angle is 247°. Accordingly, the hour in question is *after* midnight by 247°—212°=35°=$2^h\ 20^m$. In other words, the time is 2:20 A. M.

By accurate computation, the time is $2^h\ 18^m\ 2^s.3$, showing an error of less than two minutes.

As soon as the rationale of the above method is understood, the only thing that really needs to be carried in memory is the date, May 4.

The observer, who desires greater accuracy, may count the exact number of days from May 4 to the date in question, and multiply this number by (1 — 14/1000), that is, diminish it by 1½ per cent of itself. This result, expressed in degrees, may then be diminished by 0.4, since the position angle of the clock hand at midnight commencing the date May 4 is —0°.4, instead of 0°, as we took it above. The astronomer will not need to be told that the final result is expressed in sidereal time units, and will require to be converted to mean solar time units in order

to attain the "last cry" in accuracy. Finally, the local hour angle thus arrived at will have to be corrected still further in order to get standard time and "daylight saving time."

Theoretically, the above method is capable of giving quite accurate results, if the decimals are carried out sufficiently. The weak point lies in the measurement of the position angle. To measure it accurately, a specially designed instrument would be necessary. For popular purposes, a large envelope, with a pocket knife in one end, suspended on a pin through the other end, makes a fairly good plummet. Another envelope in juxtaposition with the first, and with the same pin passing through its middle, will form a straight edge to be brought into alignment with the stars. A pencil line drawn upon the first envelope along the edge of the second will indicate the position angle, which can then be measured with a protractor. In the absence of a protractor, one may be improvised with the aid of a piece of paper, a pencil, a pin, and a loop of string. The radius applied as a chord gives 60°, and successive bisections give 30°, 15°, etc.

In the end, however, after the scientist has prepared all these instruments of research, has then made his observations, and has finally calculated his results, he may possibly conclude on the whole that he could have ascertained the time equally well at the outset by looking at his watch.

36 West 91 Street, New York City, September, 1926.

REQUEST FOR MORE OBSERVATIONS OF OCCULTATIONS.

By ERNEST W. BROWN.

It appears from various investigations published during the last few years that observations of occultations of stars by the moon can furnish valuable data concerning the apparent deviations of the moon from its gravitational orbit. Their comparative freedom from systematic errors renders them of particular use in the discussion of long period changes, and the "accidental" errors, mainly those due to the roughness of the moon's edge, can be eliminated with a sufficiently large number of observations.

It is believed that more of such observations would be made if observers were assured of their value and also if they were convinced that when made they would be fully utilized.

Co-operative arrangements have therefore been made for the reduction of such observations not otherwise cared for. An annual comparison of the results with the tables and with such other observations of the moon as may be available is intended.

It is suggested that the efforts should be mainly directed towards ob-

servations of *disappearances*. Observations of reappearances require more accurate predictions if the observer is not to spend too much time in waiting, and they are subject to a systematic time-error which varies with different observers. Systematic errors due to the use of one limb only, can be taken care of in the discussion.

It may be noted that

(1) Owing to the roughness of the moon's edge, observations of occultations of the same star from positions which differ only a few miles in geographic latitude are practically independent as far as the principal errors are concerned.

(2) For the same reason, the observed time of disappearance (which is all that is required) is sufficiently accurate if obtained to the nearest second of time.

(3) That an unpredicted occultation of a star for which no good modern place is available can be utilized by observing the star after the observation has been made. Arrangements for such occasional meridian observations are under way.

It is expected that arrangements for predictions can be made for an observer who has not other facilities for securing them and who is willing to undertake a regular program of observation. In this connection, however, the brief method of prediction given on page 637 of the *Nautical Almanac* for 1925 may be mentioned.

In cases where an observer already has facilities for getting his observations reduced, it is suggested that he add to the tabular right ascension and declination of the moon, the amounts (at the present time)

$$+.212\,\Delta\alpha, \quad +.212\,\Delta\delta,$$

where $\Delta\alpha$ and $\Delta\delta$ are the variations of α, δ per minute at date. These are equivalent to adding $7''.00$ to the mean longitude of the moon. They reduce the difference between the observed and computed places (apart from observational errors) to less than a second of arc, and thus to a small extent reduce the work of reduction. The saving of time in the later discussion is very considerable, since the periodic changes due to the change of $7''.00$ in the mean longitude cannot be neglected as they may be when the difference is $1''.00$ or less. They interfere with no theoretical investigation since it has been shown that the deviation of the moon from its gravitational orbit is almost wholly accounted for by an apparent change in its mean longitude. The amount will probably have to be changed for future years, although it has remained nearly constant now for some years. A common and known amount added to all reductions in any one year will save much confusion and trouble in later discussions.

It is requested that observers who do not intend to reduce their observations publish them as promptly as convenient or send them by mail either to Mr. L. J. Comrie, at H. M. Nautical Almanac Office, Royal Naval College, London S.E. 10, England, who will in general take care

of the reductions of observations in the Eastern Hemisphere, or to me at the Yale Observatory, New Haven, Connecticut, U. S. America, for the West. In any case, duplication of the work of reduction and delays will be avoided if observers can forward their results by mail to one of us at convenient but short intervals. It is also requested that the same plan be followed with reduced observations where discussions and comparisons are not intended to be made. It is hoped that by these plans an annual discussion of the observations in any one year may be made and published before the end of the following year. Separate publications of *observations*, not otherwise recorded, will be made if so requested by the observer.

There may be some difference of opinion concerning the limitations of the program suggested above. They have been made with the idea of securing with the minimum effort the material necessary for the particular objectives which the writer believes to be of importance at the present time.

NOTES TO OBSERVERS WITH LIMITED ASTRONOMICAL EQUIPMENT.

The time to the nearest second of the occurrence of an occultation may be obtained by stop-watch and clock in the following manner:

The stop-watch should be one which will keep its rate sufficiently constant for a minute or two so that the accumulated unknown error in that time shall be less than $0^s.5$. The ordinary start-stop-zero type used in athletic contests will serve if its rate has been tested. The clock used should be one which will keep its rate constant to the same degree of accuracy for a few hours.

The observer watches for the occultation with his stop-watch set to zero, pressing the button to start it when the occultation occurs. It is then taken to the clock and the watch stopped by again pressing the button when the second hand of the clock reaches an exact minute. The number of seconds thus recorded on the watch, subtracted from the number of minutes and hours shown on the clock, gives the clock time of the occultation. The chance of making the mistake most troublesome in the later reductions and discussions, namely that of a whole number of seconds or minutes, is minimized by this procedure. Practice in the method can be obtained by observing a distant light which is obscured at irregular intervals.

Comparison of the clock with radio time signals should be made if possible before and after the observations. Recorded frequent comparisons will enable the observer to obtain full information as to the behavior of his clock.

The conditions of the observation should be noted, *i.e.* hazy, cloudy, gradual disappearance, doubtful, bright limb, dark limb. Observations should be limited, in general, to disappearances; if a reappearance be observed, an estimate of his time error should be furnished by the observer.

The geocentric coördinates of the observer's station will be needed.

If these are not known with sufficient accuracy, arrangements will be made to determine them.

It is hoped that some simple method of furnishing rough predictions of occultations for considerable districts may be made available. In the meantime, the almanac predictions for the nearest observatory may be utilized if the observer is willing to spend a longer time watching for the disappearance, taking the chance of its not occurring at all at his station. When an unpredicted occultation is observed, data sufficient to identify the star should be sent with the observation.

Yale Observatory, 1926 December.

THIRTY-SIXTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

[*Continued from page 638, Vol. XXXIV.*]

THE LUNAR APPULSE OF 1926 DECEMBER 18-19.

By William F. Rigge.

On December 19, 1926, at 12:20 A. M. Central Time, the full moon will come within 42″ of the earth's shadow. As the moon will be most favorably placed, near the meridian and with a high northern declination, an exceptional opportunity is presented of observing and measuring the varied illumination of the disk, for which its almost grazing contact with the shadow will give more time than a true eclipse.

NOTES ON PLANETARY OBSERVATIONS.

By E. C. Slipher.

This paper deals with recent observations of the planets and presents some color-filter photographs of Mars, Jupiter, and Saturn.

All three of these planets have been observed this summer with considerable regularity both visually and photographically with the 24-inch refractor and some outstanding changes in their surface markings have been recorded.

Jupiter has recently displayed widespread changes in its surface markings. Early in May the planet presented a normal appearance and about as it has appeared since 1920, but since the first of June a remarkable change has taken place over practically the whole of the southern hemisphere. The south tropical dark belt which was broad and prominent in 1925 and earlier, has almost disappeared during the last two months and now that part of the planet shows a broad bright belt that is brighter than the equatorial bright belt. It is noteworthy that the Great Red Spot has remained unaffected by this disturbance and now appears more conspicuous than for some time, perhaps due to the greater contrast produced by the brighter surroundings. The Red Spot

now shows more color than formerly, being distinctly pinkish in tint. It may be of interest to note that in 1919 a change swept over the same region of Jupiter which presented about the same aspect as this present disturbance.

Mars has been under observation since April 1 this year, the date of the occurrence of the vernal equinox of the southern hemisphere. The seasonal development of the dark markings of the southern hemisphere as well as the recession of the southern polar cap, up to the date of the Martian summer solstice which has just occurred, appears to have been practically normal. The south cap which measured fully 100° in breadth on April 1 is now less than 10° in diameter. During its recession the cap presented the same markings that were observed in it at the oppositions of 1924 and 1909. The "seas" and dark markings in the southern hemisphere now appear about fully developed and present an appearance remarkably similar to that of 1909. However, one observing Mars now would be struck by certain changes in some of the dark markings since 1924. Most striking of these changes is the darkening of the whole Deucalion region which is now very conspicuously darker than at any time in 1924, and sensibly the same as it was in 1909. The Syrtis Major and the canals to the left of it, too, have changed considerably since 1924, and the aspect of this part of the planet now closely resembles that in 1909. The Trivium Charontis and the Cerberus are now mere ghosts of what they were in 1924, and they too very closely resemble their appearance at the opposition in 1909. Other than these changes Mars appears now as it did early in October, 1924.

CORONAL DOMES.

By Frederick Slocum.

Lantern slides of the 1925 corona were shown, also a sketch from the negatives showing the equatorial wings, polar rays, coronal fog, and a fine example of a coronal dome. Similar features have been referred to as arches, synclines, leaf-like forms, semicircles, hemispheres, hoods, etc.

A perfect dome seen in profile shows reversed curves terminating in a long spike. If the dome is tilted somewhat toward or away from the observer, the spike may not be seen and the projection of the dome would be like that of a hemisphere. It is, of course, possible that there may also be hemispherical domes, without reversed curves and spikes.

Domes are frequently associated with large prominences, as for example, the "heliosaurus" prominence of the 1918 eclipse, but sometimes they enclose very small, but active prominences. That these small prominences are capable of causing domes is inferred from the frequently observed widespread influence of relatively small centers of activity on the sun.

From the known dimensions of prominences, these coronal features which cover them are assumed to be domes rather than arches. They

generally appear in concentrate series and this seems to favor the pulsation theory.

THE POSITION OF THE MOON FROM SOLAR ECLIPSE PHOTOGRAPHS.

By Carl L. Stearns.

Ten photographs of the partial phase of the solar eclipse of 1925, January 24, taken by Professor Frederick Slocum with the twenty-inch refractor of the Van Vleck Observatory, were measured for the purpose of determining the position of the moon. The method of measurement and reduction employed was in part that developed by Professor H. N. Russell in connection with his photographic determinations of the moon's position. The positions of twenty-five points on the limb of the sun and of twenty-five on the limb of the moon were measured in rectangular coördinates. After these had been corrected for differential refraction, the coördinates of the centers of the two arcs were found by the method of least-squares, using equations of condition of the form

$$(x-X_0)a + (y-Y_0)b + c = (x-X_0)^2 + (y-Y_0)^2 - R_0^2$$

in which a, b, and c are small corrections to approximate values, X_0, Y_0, R_0, of the coördinates of the center, X and Y, and the semi-diameter R. From the rectangular coördinates of the centers thus found the distance between the centers was determined and compared with the corresponding distance computed from the positions of the sun and moon given in the *American Ephemeris*.

The mean of the ten differences between the observed and the computed distance was found to be $-0''.73 \pm 0''.37$. With the latitude component of this quantity assumed to be small, the longitude component was found to be $-0''.68$, which represents the combined errors in the tabular longitudes of the sun and the moon.

This method has the advantage of being independent of any assumed values of the semi-diameters, but it probably introduces a systematic error due to differential irradiation, which may amount to as much as $0''.3$. The effect of this error could be practically eliminated by taking half the plates before totality.

THE LIGHT-VARIATIONS OF THE SATELLITES OF JUPITER AND THEIR APPLICATION TO MEASURES OF THE SOLAR CONSTANT.

By Joel Stebbins.

During a month's sojourn at the Lick Observatory in August and September, 1926, I began a series of measures of the satellites of Jupiter with the photo-electric photometer attached to the 12-inch refractor. By using a small diaphragm the diffuse light from the planet can be cut down and the four bright satellites can be observed satisfactorily except when they are too close to Jupiter. Four comparison

stars have been used, two of spectrum F0, one of G5, and one of K0, these being located so that the effect of atmospheric extinction is practically eliminated. In the course of the month only three nights were not clear and favorable.

Each observed brightness of a satellite is the resultant of its reflecting power and the light of the sun, but the difference of magnitude between two satellites is independent of the solar variation. A few measures of the satellite showed that each is variable in the period of orbital revolution, as follows:

	Period	Range
I	1.77 days	0.24 mag.
II	3.55 "	0.30 "
III	7.17 "	0.13 "
IV	16.75 "	0.10 "

It happened that observations were begun just at the opposition of Jupiter, and at once there was found a progressive diminution of the light of all the satellites, which is due presumably to the decreasing elongation of the system from the sun. For II and III this phase effect, corrected for geocentric distance, amounts to 0.13 mag. as compared with a similar change of 0.11 mag. in our moon for the same angle. The measures of I are too few to infer from, but IV seems to exhibit this effect to something like double the amount of the others.

From the variation in the orbital period and the flashing up at full phase it is evident that these satellites are probably bodies like the moon, being unequally bright over their surfaces, and each keeping one side toward the primary. Satellites I, II, and III are brighter on the front side in their motion, but IV shows the greatest light when it is receding from the earth.

None of the comparison stars have shown any indication of variability, and the mean of the four may be taken as an excellent standard to which to refer the sun. Thus far I have found no particular evidence of solar variation, but this can be tested when an accurate light-curve and the amount of the phase effect have been derived for each satellite.

From the results thus far obtained it appears that the bright satellites of Jupiter are good mirrors for testing the sun's radiation, and that by referring them to a group of comparison stars we can study the solar variation with the influence of the earth's atmosphere practically eliminated.

REPORT ON OBSERVATIONS OF THE CORONA AT THE SUMATRA ECLIPSE OF JANUARY 14, 1926.

By H. T. Stetson and W. W. Coblentz.

Photometric measures of the brightness of the solar corona at the eclipse of January 14, 1926, were made both visually and photograph-

ically at Benkoelen, Sumatra, with the assistance of Messrs. Weld Arnold and W. A. Spurr

Visual measurements of the intensity of the total light of the corona and surrounding sky were made with a Macbeth illuminometer loaned by the U. S. Bureau of Standards and especially calibrated for the purpose. Readings were taken at frequent intervals from an hour and a quarter before until an hour and a quarter after mid-totality. The resultant light-curve places the minimum illumination received from corona and sky as 0.138 foot-candles and the time of occurrence at $7^h\ 35^m\ 48^s$ G.C.T. The uncertainty of determining the time of minimum of the light-curve is probably of the order of about five seconds.

Photometric registrations were also obtained photographically on both ordinary and isochromatic plates with a coronal photometer designed by Professor E. S. King and used by him and other Harvard observers on the eclipse of January 24, 1925.

Plates of two and four seconds exposure were made during totality, the ordinary and isochromatic plates being exposed simultaneously through appropriate screens. Standardization was completed the same night by means of a series of suitable exposures to a Hefner lamp under standardized conditions.

The resulting plates when measured with the thermo-electric photometer yield for the brightness of the corona and sky within a three degree circle: photographic magnitude — 11.38, photovisual magnitude —12.00, and color-index +.62. Corresponding values determined by King for the 1925 eclipse are: —10.96 photographic, —11.61 photovisual, and color-index + .65. The photographic magnitude of the full moon has been placed at — 11.20. Measures of these plates indicate a coronal light about 40% greater at the 1926 eclipse than at the eclipse of 1925 showing an apparent increase with the sun-spot numbers.

Radiometric measures of the water-cell transmission of the coronal radiation were attempted with a twenty-inch reflecting telescope and vacuum thermocouple using the method and program carried out at Middletown in 1925. A grant from the Rumford Fund of the American Academy made possible a new galvanometer of shorter period and greater sensitivity than that employed at Middletown. High humidity and a thin veil of cirrus cloud, however, interfered seriously with the observations entailing a large amount of infra-red absorption. While the haziness and thin diaphanous clouds did not interfere seriously with the photographic work, it may well explain failure to obtain strong positive indications of coronal radiation by means of the thermopile, particularly since the method is differential and depends upon the contrast of infra-red radiation received from the centre of the shadow cone and that from the coronal light itself.

A more complete account of the data obtained and a fuller discussion of the material will appear elsewhere.

A SURVEY OF THE VARIABLE STARS IN THE REGION 15 DEGREES SQUARE AROUND MESSIER 11.

By Margaret L. Walton.

One of the problems of the Maria Mitchell Observatory has been to take photographs of certain regions of the Milky Way in order to make a search for faint variable stars.

For the region fifteen degrees square surrounding Messier 11 twenty-two plates have been taken since 1918, sixteen of which show stars of magnitude 15.5 or fainter. An examination of these plates has yielded thirty new variables. The position for 1900 and the range in magnitude for each of these stars are given in Table I. No periods have as yet been determined.

Table I.

Des.	R. A.	Dec.	Observed	
			Max.	Min.
	h m s	° ′		
1	18 29 24	—1 59.6	12.6	13.7
2	36 12	—1 11.7	13.6	15.1
3	36 50	—4 26.4	12.0	12.6
4	37 36	—4 40.6	13.2	13.8
5	40 49	—4 43.3	13.1	14.6
6	41 04	—5 15.0	12.7	13.4
7	41 23	—2 07.3	14.5	15.2
8	42 03	—4 51.6	12.5	13.3
9	42 14	—2 19.8	13.6	14.5
10	44 52	—4 29.1	12.9	15.3
11	45 43	—2 06.9	12.8	14.0
12	45 52	—7 55.1	11.1	11.8
13	48 49	—0 34.5	13.3	14.5
14	52 12	—5 56.2	12.8	14.1
15	54 14	—5 22.2	14.9	[15.7
16	52 25	—3 10.5	13.7	14.9
17	54 29	—2 00.8	12.4	14.2
18	54 57	—8 49.5	14.5	[15.4
19	55 32	—0 35.9	12.0	13.6
20	55 54	+0 06.0	14.3	15.1
21	56 45	—2 59.5	13.3	14.8
22	18 57 21	—4 31.0	14.5	15.2
23	19 00 07	—3 44.8	14.0	16.
24	01 51	—2 09.1	12.4	13.2
25	02 34	—6 54.7	14.2	15.3
26	03 12	—1 15.3	13.8	14.5
27	03 31	—6 59.0	13.8	15.3
28	05 01	—0 31.4	13.5	14.7
29	09 24	—1 07.4	13.7	15.2
30	10 34	—2 30.1	12.5	13.3

There are 193 known variable stars in this region; 105 were identified on the Nantucket plates, and the rest were either too faint to be seen, or were long period variables which had no maxima at the times the plates were taken. The number of variable stars of each type in the region are listed in Table II. This does not include the new variables.

TABLE II.

Type	No. of Objects
Long Period	33
Cepheid	21
Eclipsing	14
Irregular	7
Beta-Lyrae	1
Novae	4
Nova-like	1
Unknown	112

The long-period variable, AW Scuti, was found to have maxima in April 1923, August 1924, and in July 1926. This makes the period appear to be about 230 days, instead of 465 days, as previously assumed.

THE VELOCITY-FIGURE OF THE B-TYPE STARS

By Ralph E. Wilson.

From the space motions of 348 stars of Classes B0 to B5, whose proper-motions were based upon Raymond's revision of the Boss system and from whose radial velocities a K-term of +4.0 km/sec. was eliminated, the following coördinates of the solar motion and of the principal axes of the velocity-figure were obtained:

A_0	277°.8	D_0	+30°.2	V_0	16.7 km/sec.
A_1	93.0	D_1	−33.5	V_1	8.1
A_2	54.6	D_2	+61.0	V_2	6.7
A_3	169.8	D_3	+19.4	V_3	5.1

It is shown that these stars tend to move in the plane defined by their positions on the sky, which is inclined at a small angle to the galactic plane. The avoidance of motions toward the poles of this plane is about the same as the avoidance toward the poles of the galaxy in stars of the other spectral classes. The axis of preferential motion lies very closely along the line of the solar motion. Two isolated high-velocity stars and a single high-velocity group show the same tendency as the high-velocity stars of other classes in their avoidance of motions toward the first galactic quadrant.

REPORT OF THE COMMITTEE ON METEORS.

The committee desires to report to the Society the following resolution, hoping that the members of the Society will lend their aid in making it effective. It having been found impracticable properly to collect data concerning fireballs and meteorites, seen everywhere in America, at any one place, and it being well known that such data have great value, we therefore recommend:

That the United States and Canada be divided into districts of convenient size, each containing some well-known institution or individual agreeing to act as a center, to which all data concerning fireballs and meteorites from the district may be sent.

We request volunteers to act in such capacity in those parts of the country not yet provided for. The following observatories have so

far agreed to act for the surrounding regions: Ann Arbor, Harvard, McCormick, Ottawa, and Syracuse.

It can further be reported that in the past year a good deal of theoretical work on meteoric astronomy has appeared or is in preparation for publication. An average number of observations have been reported to the American Meteor Society by its members, and recently a large number of new members have joined. A real revival of interest in observing is therefore hoped for in the near future.

Dr. W. J. Fisher of Harvard College Observatory has made excellent progress in the examination, measurement, and computation of the numerous photographic trails of meteors found upon their collection of plates.

The observational work of the American Meteor Society, for the years 1919 to 1925 inclusive, is now being prepared for publication by C. P. Olivier. It is hoped that the results may be published within a year.

In closing this report the chairman desires to say that he would welcome suggestions from persons not on the committee, but who are interested in the subject, as to how the committee could most effectively aid in advancing meteoric astronomy.

CHAS. P. OLIVIER, *Chairman.*

REPORTS OF OBSERVATORIES
1925-1926

The reports which follow are arranged alphabetically according to the names of the observatories or of the instiutions with which they are connected. Unless otherwise noted, each report covers the twelve months ending June 30, 1926.

ALLEGHENY OBSERVATORY
UNIVERSITY OF PITTSBURGH
PITTSBURGH, PENNSYLVANIA

There have been no changes in personnel during the year. Mr. Curtis was absent from the Observatory for six months in connection with the total solar eclipse of January 14, 1926, which he observed at Benkoelen, Sumatra, as a member of the expedition sent out by Swarthmore College. In preparation for this eclipse, considerable work was done in modifying eclipse apparatus, including the construction of three eclipse driving clocks.

Though the staff was thus "short-handed" for a considerable portion of the year, good progress has been made in the three major programs of work of the Observatory, namely,—extra-focal photometry, in charge of Mr. Jordan; standard solar wave-lengths, in charge of Mr. Burns; and photographic parallax determination, in charge of Mr. Daniel.

The number of plates taken during the year with the Thaw Photographic Refractor was 2281, the greater portion of these being on the parallax program. Over 730 plates were measured during the year, the majority by Mrs. Crissman, and about 140 stars are now ready for publication.

For a considerable proportion of the variable stars on Mr. Jordan's extensive photometric program the work is approaching completion, both as regards the taking of the plates and their measurement and reduction; it is hoped that it may be possible soon to begin the publication of this part of his results.

Excellent observational progress has been made during the year in the program of determination of standard solar wave-lengths by the grating-interferometer method. This is a coöperative program entered into by the Allegheny Observatory and the Bureau of Standards; the plates are taken at the Allegheny Observatory, and the work of measurement divided between the two institutions. The share of the Allegheny Observatory in this program is in charge of Mr. Burns. An account of the method, with standard solar wave-lengths as determined in the region 4073 A to 4754 A, was published during the year by Burns and Meggers as No. 7 of Vol. VI of the *Publications of the Allegheny Observatory*.

Five thousand eight hundred visitors were entertained during the year in the Frick Public Evening Service, in charge of Mr. W. R. Ludewig.

HEBER D. CURTIS, *Director*.

STUDENTS' OBSERVATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

During the academic year 1925-26, Mr. Leuschner was away on sabbatical leave, and Mr. Crawford served as acting director.

During his leave Mr. Leuschner attended the meeting of the International Astronomical Union held in Cambridge in June, 1925, as well as meetings of other important societies.

At various times throughout the year we had delightful visits from several prominent astronomers, among whom were Littell of the Naval Observatory, Curtis of the Allegheny Observatory, Hagihara of the Tokyo Imperial University, and Van Biesbroeck of the Yerkes Observatory.

In February Charlier's memoir was issued from the University Press.

In the second semester Mr. Trumpler of the Lick Observatory and Mr. Meyer of this Observatory exchanged stations. The courses given here by Mr. Trumpler were well attended and much enjoyed. This is the second exchange of members of the staffs of these two observatories. It has proved so beneficial that future exchanges will be made whenever the conditions at the two places are favorable for them.

During the year four *Lick Observatory Bulletins* were issued from here. These contain investigations of the orbits of Brooks' periodic comet *g* 1925 by Storer and Mendenhall; of (1024 UA) by Maxwell; of comet *j* 1925 (Van Biesbroeck) by Maxwell and Damsgard; and of comet *b* 1926 (Blathwayt) by Maxwell and Storer.

The regular work of instruction in the University was carried on as usual, except that Mr. Shane, who is normally on half time in this department and half time in the department of mathematics, devoted his whole time to this department because of the absence of Mr. Leuschner.

A new transit was ordered from the Gaertner Corporation but has not as yet been delivered.

R. T. CRAWFORD, *Acting Director.*

OBSERVATORIO NACIONAL ARGENTINO

CÓRDOBA, ARGENTINA

(Year ending December 31, 1925)

Owing to the reconstruction of the Observatory, which has been interrupted for a year and a half, it has been impossible to continue our programs of observation. The necessary observations for the determination of the clock errors, a few DM observations and spectrograms of Nova Pictoris are all that were attempted.

As far as conditions permitted, the efforts of the staff were devoted to the reductions of the observations for the new fundamental catalog and to the preparations of the measures of the Astrographic plates for printing.

Two catalogs were printed. The third of our A. G. zones —32° to —37° (and the last of the zone —22° to —37°) was printed and distributed as Vol. 24 of the *Resultados*. The first of the Astrographic measures, —24°, Vol. 26 of the *Resultados,* was printed and will be distributed early in 1926. The printing of the zone —25°, Vol. 27, was begun. The measures of —26° are practically ready for the printer. It is expected that the zones —27° and —28° will be ready by the end of 1926. The reductions of the remaining zones are under way.

The charts of the first zone, —25°, of the Carte du Ciel, 180 in number, are ready for distribution, and will be sent out early in 1926. Those of the next zone, —27°, are nearly ready. The plates of —29° are being engraved. All of the photographs have been obtained, the last being secured in 1924.

2320 observations for the DM were secured in the zones —63° to —72°.

Some progress was made on the preparations of the DM maps in the zone —42° to —62°, but owing to the illness of the engraver, this work was considerably interfered with.

Some progress was made on the detailed plans of the dome structure in the Sierras.

C. D. PERRINE, *Director.*

DOMINION OBSERVATORY

OTTAWA, CANADA

Staff. Mr. D. A. Barlow joined the staff on June 28, 1926. He will coöperate in the spectrographic work with the 15-inch equatorial telescope.

Meridian Work and Time Service. Observations with the meridian circle were continued on the same program as previously. Over 4200 observations on stars and 113 on the sun were made in right ascension and declination. The meridian circle was reversed on its axis about the beginning of each month.

The time service in the Government buildings was continued with no material changes. Time signals were sent out daily, except Sunday, over the telegraph line and twice weekly by radio over the Canadian National Railway's station CNRO. The time signals from Annapolis, Lafayette and Nauen radio stations were observed regularly. Special time signals were also observed as required for survey purposes. Some experimental work on transmission and reception was done in collaboration with other institutions.

Solar Physics. Cloudy and hazy conditions prevailed and only 150 observations of spectra of solar limbs, centre and iodine comparison were made. Some 370 measurements and about 1400 computations were carried out, mainly in completing the 1910 series of solar rotation observations. Tables were computed and a graphic device constructed for calculating the components of the earth's orbital velocity to points on the sun. The b-lines of magnesium promise to yield a good value of the predicted relativity shift on the assumption of vacuum conditions in the sun, these lines giving very little range in wave-length over the solar disc, but the strict comparison with the Pfund arc will have to be made.

Radial Velocity. Spectrograms to the number of 723 were secured, special attention being given to the bright Cepheids, η Aquilae and ζ Geminorum, as well as to certain remarkable triple systems on which the work was continued. Radial velocities in the Cepheids for ionized and neutral lines, high and low level, were measured and curves of atmospheric ionization determined. σ Scorpii was also studied for three consecutive months during this the ninth year of observation. The bright-line star ϕ Persei was investigated, in continuation of the early work at this Observatory. A photo-electric photometer was mounted and preliminary adjustments made. A book of about 300 pages was written on Double and Multiple Stars as a part of the series of volumes on astrophysics being published in Germany.

Photographic Photometry. The determination of comparison star magnitudes in Cepheid fields was continued, and 150 plates covering over 50 fields were made. A regular program with the 2-inch cameras

was started in April, and over 100 plates of Cepheid variables were taken. The measurement and reduction of the comparison plates are being carried on in accordance with the program calling for three plates in each field.

Seismology. Earthquakes to the number of 383 were registered and these were reported in monthly bulletins to 222 stations. The seismographs have been in continuous operation at Ottawa, and, except for temporary suspensions for repairs, also at Halifax, Saskatoon, and Ste. Anne de la Pocatiere. Considerable work was done in connection with the establishment of two new stations for Wood-Anderson instruments in the seismic region of Quebec, which work was undertaken with the coöperation of power companies. Further data were secured for the report of the earthquake of February 28, 1925. Bibliographical bulletins were prepared and distributed in coöperation with the Eastern Section of the Seismological Society of America.

Terrestrial Magnetism. During the year magnetic work was carried on mainly for the purpose of securing secular change data. The three magnetic elements, declination, inclination, and horizontal intensity were determined at forty-three stations, thirty-six being "repeat" and the remainder new stations. Of this number thirty-six are located in the section of country lying east of longitude 80°W and south of latitude 52°N; the remaining seven are along the Labrador Coast, the most northerly being at Nain.

Gravity. Sixteen stations in Saskatchewan, Alberta, and British Columbia were occupied during the year. The results of the gravity survey in the western mountains were reduced.

Publications. One of the regular series of *Publications of the Dominion Observatory* was issued during the year and several others prepared. A number of papers were published in scientific journals, and several radio talks given.

R. Meldrum Stewart, *Director.*

GOODSELL OBSERVATORY

Carleton College

Northfield, Minnesota

The most important event of the year was the meeting of the American Astronomical Society in Northfield on September 8 to 11, 1925. Because of the international meeting at Cambridge and because of our out-of-the-way location the attendance was below average, but we believe those who attended felt amply repaid. The Observatory staff hopes that at some future time Northfield may again be honored by a meeting of the Society.

Messrs. Wilson and Gingrich continued the photographic observation of asteroids. The results of about 80 plates were prepared for publi-

cation, and will be issued as No. 11 of the Observatory *Publications* in the near future.

As in former years a considerable portion of the time of the Observatory staff has been given to the instruction of about one hundred students in astronomy and to the editing and publication of *Popular Astronomy*. The undersigned also devoted considerable time to the preparation of an elementary text-book on astronomy. Monthly star talks were given through the college radio station KFMX.

The time service for the railways of the Northwest has been continued and time signals have been sent out each week day from 10:28 to 10:30 A.M. Central Standard Time. When the college is in session the signals are also broadcast by KFMX on 337 meters.

The photo-electric photometer has not proved satisfactory and it was thought best to rebuild it. As the local machine shops could not be used satisfactorily for the purpose, a shop was installed in the basement of the Observatory. The equipment includes a small engine lathe, milling machine, drill press and tool grinder. A three horse-power electric motor furnishes the power. Some of the reconstruction has been carried out by the writer and it is expected that it will be finished by the end of the calendar year.

The Observatory was open to visitors each Saturday evening during the college year. Many took advantage of the opportunity to see the more important celestial objects.

There was no change in the staff until the end of the year at which time Professor Wilson retired from active service. He had been connected with the Observatory for thirty-nine years and had served as director since 1908. This richly deserved freedom from his duties as teacher, editor, director, and research worker will enable him to do many other things in which he has been interested but for which he had no time. He plans to spend the next year in California and then we hope to welcome him again to Northfield.

E. A. FATH, *Director.*

LICK OBSERVATORY

UNIVERSITY OF CALIFORNIA

MOUNT HAMILTON, CALIFORNIA

The major part of the resources of the Observatory and of the energy of its staff in the year ending June 30, 1926, was devoted to the effort to conclude several long observing programs and to put the results into form for publication. The largest of these programs is the one initiated about thirty years ago by Mr. Campbell, to secure measures of the radial velocities of the stars as bright as 5.51 visual magnitude in both hemispheres of the sky. Mr. Moore has been in charge of this program and has been assisted in the observations at Mount Hamilton during the year by Messrs. Jeffers, Balmer, Meyer, Jacobsen and

Mendenhall. All of the observers and also Miss Dorothy Applegate and Miss Dorothea Havens participated in the work of measurement and reduction. At the Chile Station, the work was in charge of Mr. Neubauer, who was assisted by Mr. Sterck.

By the close of the year, the program had been completed and the first copy of the manuscript giving the results of the work had also been made. This copy is now in process of thorough revision, and advantage has been taken of the necessary delay before publication to repeat the observations of a considerable number of stars which were observed prior to about 1910, and at no later dates. It is hoped that the entire work, giving the radial velocities of about 2600 stars and including a new determination of the solar motion, may be sent to the printer early in the calendar year 1927.

The solution for the solar motion, just referred to, rests upon the radial velocities of 2,119 stars, (nearly all giants), for spectroscopic binary stars whose orbits are unknown, and a considerable number of stars belonging to known moving clusters were necessarily excluded. It is found that the solar system is travelling toward a point in 271°.5 right ascension, +28°.6 declination, with a velocity of 19.6 kilometers a second. This result is in all particulars in good agreement with the results of earlier determinations made here, when smaller numbers of stars had been observed.

At the Chile Station, the observing program has been extended to include stars with visual magnitude brighter than 6.51, and 260 spectrograms of these fainter stars have been secured during the year.

Dr. R. H. Tucker, who has been in charge of the meridian circle work continuously since 1893, except for a period of three and a half years in 1908-11 when he was director of the Southern Observatory of the Carnegie Institution at San Luis, Argentina, reached the retiring age during the year and became emeritus astronomer on July 1, 1926. Volume XV of the *Lick Observatory Publications,* containing his meridian work in the years 1905 to 1925, was distributed in November. Mr. Tucker signalized his final year here by making a remarkable record for winter observing. His program comprised the two lists of comparison stars selected for the photographic observations of the minor planet Eros, which are to be made at the opposition of 1930-31. Of the 76 nights devoted to this work, 21 fell in the month of January and 12 in December, and observations were made on 24 out of 30 consecutive nights following Christmas, 1925. This is a record quite without precedent here for winter observing. The 419 stars of the first list were all observed twice, and 261 out of the 402 stars of the second list were observed on one night each. Stormy weather prevented further measures before the stars were lost in daylight in the late spring months.

A third long program of work relates to the stars in the "open" clusters, which include such large and bright groups as the Pleiades and also many fainter ones. Mr. Trumpler has now photographed nearly

all of the brighter clusters, some 50 in number, with the slitless quartz spectrograph attached to the Crossley reflector, with exposures of from 5 to 7 hours. These spectrograms permit estimates of the spectral classes of all stars to the 14th magnitude. To supplement these plates, Mr. Trumpler has endeavored to secure spectrograms with the 1-prism spectrograph attached to the 36-inch refractor of all the stars in the brighter open clusters, like the Pleiades, Praesepe and Coma Berenices clusters, and of 10 to 12 stars in every one of the other clusters. Including plates of comparison stars, 209 such spectrograms were secured during the year. The spectrographic observation of the Pleiades stars has now been completed, but additional data are needed for a number of the other clusters.

Mr. Aitken has continued his program of measurement of close double stars and has secured 500 sets of measures during the year. These relate chiefly to the stars of his own discovery. In addition, he has devoted some time to completing the survey of the zone —14° to —18° in the winter sky section, from 2^h to 10^h R.A. About 50 new double stars have been discovered as the result of this search. It was the original intention to leave this sky area to observers in the southern hemisphere, but it has developed that they prefer to begin with —19°, the northern limit of the Cape Photographic Durchmusterung. Mr. Aitken received assurance late in the year that the Extension to Burnham's General Catalogue of Double Stars would be recommended for publication by the Carnegie Institution as soon as the manuscript was ready. Work on this was at once begun, and it is hoped that it may be completed early in 1928.

Mr. Wright has continued his studies of the Novae and during the year has prepared for publication and sent to the printer a discussion of the spectrum of Nova Geminorum 1912. This paper will form Part 2 of Volume XIV of the *Publications of the Lick Observatory*.[1] It is obviously impossible to summarize in brief form the detailed results given in this very complete investigation of one of the most interesting stars of this class.

Nova Pictoris, discovered in May, 1925, was followed carefully by Mr. Neubauer, at the Chile Station, and the fine series of spectrograms secured by him was utilized by Mr. Wright in a preliminary study which was published in October, 1925. The observations are being continued and a more detailed investigation will be undertaken later.

In addition to these longer working programs, many shorter investigations have been carried out. Mr. Jeffers, besides assisting in the radial velocity work, kept the 10 comets of 1925 and Comet *b* 1926 under observation, securing in all, 55 visual measures and 25 photographic plates. A large proportion of the measures were utilized at the Students' Observatory, Berkeley, in orbit computations.

[1] Distributed in September, 1926.

Mr. Moore secured several spectrograms of the companion of Sirius, using a light flint 60°-prism and a 12-inch camera in conjunction with the 36-inch refractor. On two of the plates the spectrum of the companion is distinctly separated from that of Sirius in the region from Hβ to Hδ. The spectral class of the companion appears to be about A5. Unfortunately, the spectra are too narrow for accurate determination of the line displacements.

Mr. Jacobsen secured 105 spectrograms of certain Cepheid variable stars and utilized them in his dissertation for the doctor's degree, which was published as *Lick Observatory Bulletin* No. 379.

Mr. Ch'ing-Sung Yü obtained 56 plates of the brighter Class B stars and 15 of the brighter Cepheid variables, with the slitless quartz spectrograph attached to the Crossley reflector, to continue his studies of stellar spectrophotometry along the lines of his earlier investigations of the Class A stars.

Dr. W. F. Meyer was in residence during the second half of the year, by virtue of an exchange arrangement with the Berkeley Astronomical Department, Mr. Trumpler, in that semester, conducting classes in Berkeley. Mr. Meyer devoted his time to spectrographic work, particularly to observations of spectrographic binary stars. An orbit of 112 Herculis, based upon his own plates, has been published; the 22 plates of 45 *l* Herculis are now being utilized in an orbit determination, and investigations of several other binaries including 111 Herculis, δ_2 Scuti and ϵ Librae.

Mr. Wright and Miss Applegate completed and published an account of the spectrum of α Cygni between wave-lengths 3000 and 3300 A.

Mr. Piet van de Kamp completed and published an investigation of the sun's velocity with respect to stars of magnitude 9 and 10. This work served as his thesis for the doctor's degree, which was awarded to him.

Miss Leah B. Allen, assistant professor of astronomy at Wellesley College, continued to hold the Martin Kellogg Fellowship until August 1, 1925, and completed an investigation of 20 southern variable stars of Class Me, which was published in November, 1925.

Professor R. H. Curtiss, of the University of Michigan was in residence for a month in the late spring of 1926, devoting his time chiefly to a study of the "undisplaced" *H* and *K* lines in the spectrograms of Novae available here.

There were no material changes in the staff at the beginning of the year, but on June 30, 1926, Mr. Tucker retired, as already noted, and Mr. H. F. Balmer, assistant, resigned to accept the position of instructor in the University of Michigan. The re-organization thus made necessary belongs to the history of the year 1926-27.

R. G. Aitken, *Associate Director.*

[*To be continued.*]

A METHOD OF DETERMINING THE CALENDAR DATE OF THE CURRENT DAY.

By C. E. WHITE.

We will first derive a method of finding the day of the week on which any past date fell or any future date will fall and derive the method emphasized by the title as a deduction. The latter method is emphasized because of its practical value.

The day of the week that any date will fall on or did fall on is determined in part by each of the four elements of the date—the century, the year of the century, the month, and the day of the month. This observation and the fact that every advance of seven days means a repetition of the days of the week, enable us to derive a method of finding the day of the week for any date by addends for each of the parts of a date and residuals found by subtracting multiples of seven.

We observe that January 1, 1900, was on Monday. We will let zero be the addend for the century and also for the year and we let 1 be the addend for the month and the day of the month. We so select our addends because we wish to eliminate the addend for the century for any date of the century and because we observe that $0 + 0 + 1 + 1$ divided by seven gives a remainder of 2, which indicates that the date came on Monday (counting Sunday the first day of the week). Observing that each common year advances the time one day relative to the week and each leap year advances the time two days relative to the week, we find the addend for the century and also the year of the century by adding to the number of years the number of leap years and noting the remainder where the sum is divided by seven—for any preceding century, we subtract the addend so found from seven to find the addend for that century. Thus, $(100 + 24) = 5 \pmod 7$, $7 - 5 = 2$, the addend for 1800 and $(100 + 25) = 6 \pmod 7$, 6 is the addend for 2000. Since there are 31 days in January, if 1 be the addend for January $(1 + 31 - 28 = 4)$ 4 will be the addend for February. In like manner, we find the addends for the twelve months to be from January to December: 1, 4, 4, 0, 2, 5, 0, 3, 6, 1, 4, 6 except that for leap years the addend for January is 0 and for February is 3. The addend for the day of the month is found by subtracting the greatest multiple of seven that can be subtracted.[1]

Let it be required to find the day of week the Christian Era began on, that is the day of the week, January 1, year 1[2] came on. In 1900 years there have been 475 — 13 leap years, there being 13 more leap years in

[1] Compare with a method given in Royer's Arithmetic and also a method given in Moulton's Astronomy.

[2] There was no year zero A. D. but astronomically speaking there was a year zero B. C.—in chronology this year is called year 1, B. C.

the Julian Calendar than in the Gregorian. $(1900 + 475 - 13) = 3 \pmod 7$, $7 - 3 = 4$ the addend for the first century. $4 + 7 + 7 + 1 = 0 \pmod 7$—when the remainder is zero we count it 7 instead. Hence the Christian Era commenced on Saturday.

Let it be required to find when December 25, 1930, will come. The addend for the year is—$(30 + 7) = 2 \pmod 7 - 2$. The addend for the month is 6 and for the day is $25 - 21 = 4$. $(2 + 6 + 4) = 5 \pmod 7$. Hence, Christmas will come on Thursday for that year.

The following rule which is a deduction from the above, the writer has found to be very practical in getting the calendar date for the current day. In general, it is known whether the date is near the 7th, 14th, 21st, or 28th and we can find when these dates come in the week for any month by the remainder found be dividing the sum of the addends for the month and the year of the century by 7. The sum of the assumed date and the number representing the position of the current day relative to the week minus the day of the week of the assumed date will give the calendar date for the current day.

The above rule is practical because it is easy to remember the addends for the months—1, 4, 4, 0, 2, 5, 0, 3, 6, 1, 4, 6—by the relation $12^2, 0, 5^2, 0, 6^2, 12^2 + 2$. The addend for the year is easily computed—thus for 1926 $(26 + 26/4) \div 7$ gives a remainder 4 and after using the number a few times one has it memorized for the year.

The current day is Thursday after Sept. 14, what is the date? $6 + 4 = 3 \pmod 7$. The 14th was on Tuesday and Thursday is two days later. The current date is September 16. What will be the date of Thanksgiving, 1926, November 28th will come on $[(4 + 4) = 1 \pmod 7]$ Sunday and the Thursday preceding will be November 25.

After a little practice, the computation can be made rapidly and the date determined before one could get it from a calendar not visible from one's position.

Muskingum College, New Concord, Ohio.

A METHOD OF FINDING THE DATE OF EASTER WITHOUT USING A TABLE.

By C. E. WHITE.

In the article on the calendar in the Encyclopedia Britannica, the time of Easter is determined by three tables—a table to determine the dominical letter, a table giving the epact corresponding to a golden number for the different centuries, and a table that must be entered with the epact to get the time of paschal new moon which may come in March or April. After determining the time of paschal full moon by adding 13 days to the time of paschal new moon, the last table is

entered again with the dominical letter and this date to get the date of Easter.

The following is a convenient method for finding the date of Easter for this century and the next two centuries. A similar method could be derived for other centuries. The method is independent of tables and reduces the problem of finding Easter to a problem in mental arithmetic. The process consists of five steps:

First. Find the golden number for the year by dividing the year increased by one by 19 and noting the remainder which is the golden number. Since 1900 is divisible by 19, 1900 can be subtracted from the year in this century and succeeding centuries.

Second. Find the date of the first new moon coming after the 7th of March. We will first show how this can be done by means of a table and then show how the table can be dispensed with. In the following table, the first row of numbers are the golden numbers from 1 to 19 and each of the numbers in the second row gives the date of paschal new moon in March for the year having the golden number just above it. These numbers are each derived from Table IV in the article on the calendar in the Britannica.

Golden Numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Date of New Moon	2	27	10	29	18	7	26	15	4	23	12	31	20	9	28	17	6	25	14

The dates in the table will be the dates of paschal new moon unless the dates be March 2, 4, 6, or 7 and in these cases paschal new moon will be on April 1, 2, 4, and 5, respectively—the time being advanced 30 days for March 2 and 29 days for the other dates. To make the computation without the table we observe that we can find the date under an odd golden number by multiplying it by 4 and subtracting 2 and also 30 or 60 when possible and that the date corresponding to an even golden number can be found by multiplying it by 4 and adding 13—subtracting 30 or 60 when possible except when the number is 31. Thus, if the golden number is 7 the date is $4 \times 7 - 2 = 26$, and if the golden number is 8 the date is $4 \times 8 + 13 - 30 = 15$.

Third. Find the paschal full moon by adding 13 to the date of the new moon. Thus when the golden number is 11 the date of new moon is March 12 and the date of paschal full moon is March $(12 + 13)$ or March 25.

Fourth. Find the day of the week that the paschal full moon comes on by the method described in the preceding article.

Fifth. Find the date of Easter by adding to the date of paschal full moon the number of days till the Sunday following, or add $8 - d$ to the date of paschal full moon where d is the day of the week that paschal full moon comes on.

Let it be required to find when Easter comes in 1926. $26 + 1 = 8 \pmod{19}$. The date of full moon is $(8 \times 4 + 13 - 30 = 15)$ March 15. The date of full moon is March $(15 + 13)$ or March 28. The day of the week March 28 comes on is $[(4 + 4) = 1 \pmod{7}]$

Sunday. The date of Easter will be the next Sunday, April 4. Let it be required to find when Easter comes in 2030. Subtracting 1900, $130 + 1 = 17$ (mod. 19). The date of new moon is $(17 \times 4 - 2 - 60)$ March 6, which is a date in March too early for paschal new moon. Advancing the time 29 days, we find paschal new moon comes on April 4 and full moon on April 17. April 17, 2030, comes on $[6 + 3 + 0 + 3 = 5$ (mod. 7)] Thursday. Since Sunday comes three days later than Thursday, Easter will come on April 20.

Muskingum College, New Concord, Ohio.

PHENOMENA FOR 1927.

Eclipses.

There will be five eclipses during the year, three of the sun and two of the moon. From the *American Ephemeris* we obtain the following data:

ANNULAR ECLIPSE OF JANUARY 3, 1927.

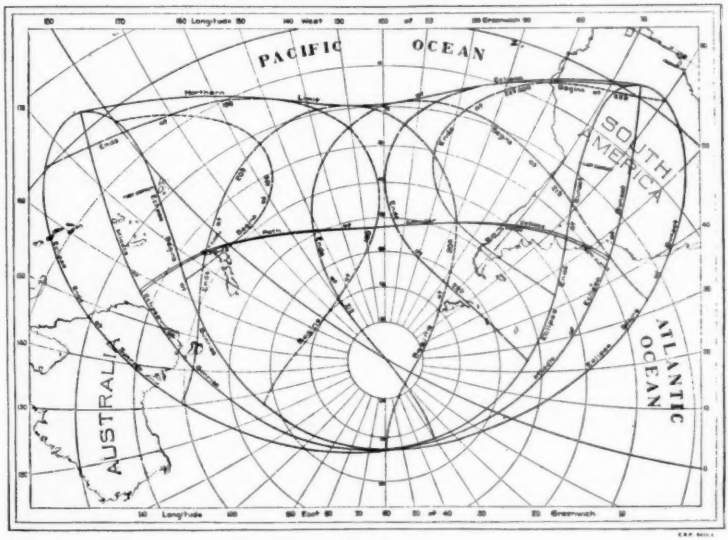


Fig. 1.

1. On January 3 there will be an annular eclipse of the sun. The path of the central line extends from eastern Australia, touches northern New Zealand, crosses South America from about latitude —40° on the west coast to —30° on the east coast and ends only a short distance from the latter point (see Fig. 1 on this page).

2. A total eclipse of the moon will occur on June 15. The beginning will be visible generally in the Atlantic Ocean, in North America except along the

northern border, in South America and in the Pacific Ocean; the ending visible generally in North America except the northeastern part, in South America except the extreme eastern part, in the Pacific Ocean and in Australia. The circumstances of the eclipse are as follows:

	Greenwich Civil Time		
	d	h	m
Moon enters penumbra	June 15	5	34
Moon enters umbra	15	6	43
Total eclipse begins	15	8	14
Middle of eclipse	15	8	24
Total eclipse ends	15	8	35
Moon leaves umbra	15	10	6
Moon leaves penumbra	15	11	15

The magnitude of the eclipse will be 1.018 (Moon's diameter = 1.0).

TOTAL ECLIPSE OF JUNE 29, 1927.

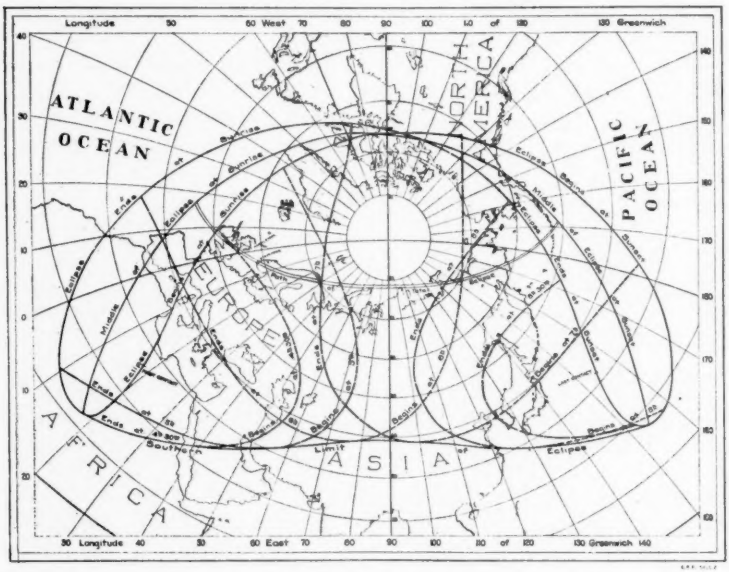


FIG. 2.

3. On June 29 there will be a total eclipse of the sun. The central line begins in the eastern Atlantic, crosses England, then runs the length of the Scandinavian peninsula and into the Arctic Ocean, crosses northeastern Siberia and ends in the north Pacific a short distance south of the Aleutian Isles (see Fig. 2, above). Totality will be short, less than 25 seconds in England, from 30 to 45 seconds in the Scandinavian peninsula and only 50 seconds at the maximum in the Arctic Ocean.

4. A total eclipse of the moon will occur on December 8. The beginning will be visible generally in the Pacific Ocean except the southern part, Australia, the Indian Ocean, Asia, the eastern part of Africa, the eastern part of Europe and the northern border of North America; the ending visible generally in the

western part of the Pacific Ocean, Australia, the Indian Ocean, Asia, Africa and the northern part of North America.

The circumstances of this eclipse are as follows:

	Greenwich Civil Time			
		d	h	m
Moon enters penumbra	Dec.	8	14	53
Moon enters umbra		8	15	52
Total eclipse begins		8	16	54
Middle of eclipse		8	17	35
Total eclipse ends		8	18	15
Moon leaves umbra		8	19	18
Moon leaves penumbra		8	20	17

The magnitude of the eclipse will be 1.358.

5. There will be a partial eclipse of the sun on December 24. It will be visible generally only in the Antarctic Ocean. The magnitude of greatest eclipse will be 0.549 (Sun's diameter = 1.0).

The Sun.

In addition to the three eclipses of the sun already considered, attention should also be called to sun-spots. Some very large ones have been observed during the past year and there may be more visible in the coming months.

The Planets.

Mercury begins the year in Ophiuchus, makes a complete circuit of the heavens and ends the year in Sagittarius. There will be loops in Pisces in March, in Gemini and Cancer during July and August and a reversed S-curve in Libra during the last half of October and November. A transit of Mercury will occur on November 10. The ingress will visible generally over the Pacific and Indian Oceans, Australia, Asia except the northern and western parts, and the extreme eastern part of Africa; the egress will be visible in Australia except the eastern part, Asia except the northern part, the Indian Ocean, Europe, Africa, the Atlantic Ocean and the extreme eastern part of South America.

Venus begins the year in Sagittarius and ends it in Libra. The path makes one loop in Sextans and Leo from August to November.

Mars begins the year in Aries and moves steadily eastward until it reaches Ophiuchus in December. Its distance from the earth increases from 73 million miles on January 1 to 242 million miles on September 29. The planet will be in conjunction with the sun on October 21.

Jupiter will pass the year in Aquarius and Pisces. Toward the end of the year it will be near the celestial equator and not long thereafter it will reach northern declinations so that it will be in better reach for northern observers than it has been for the last five or six years. Opposition will occur on September 22.

Saturn will pass the year in Scorpio and Ophiuchus. Its southern declination will increase on the whole. It will be very favorably situated for observers in the southern hemisphere. Opposition will occur on May 26.

Uranus will pass the entire year in Pisces. It will be near the vernal equinox all this time. Opposition will occur on September 25.

Neptune will be in Leo near Regulus throughout the year. On October 27 the planet will be less than two minutes of arc north of the star. Since this is less than a month before quadrature it will be possible to observe this close approach easily in the morning sky.

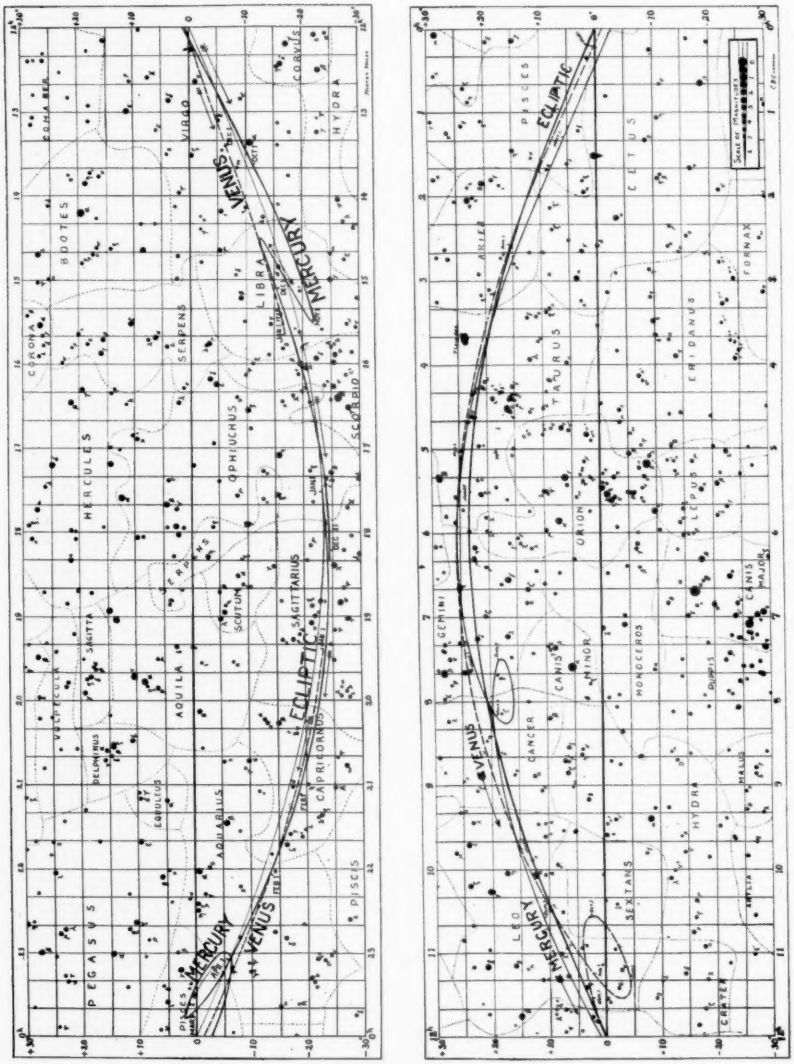


FIG. 3.

Apparent paths of the planets Mercury and Venus among the stars during the year 1927.

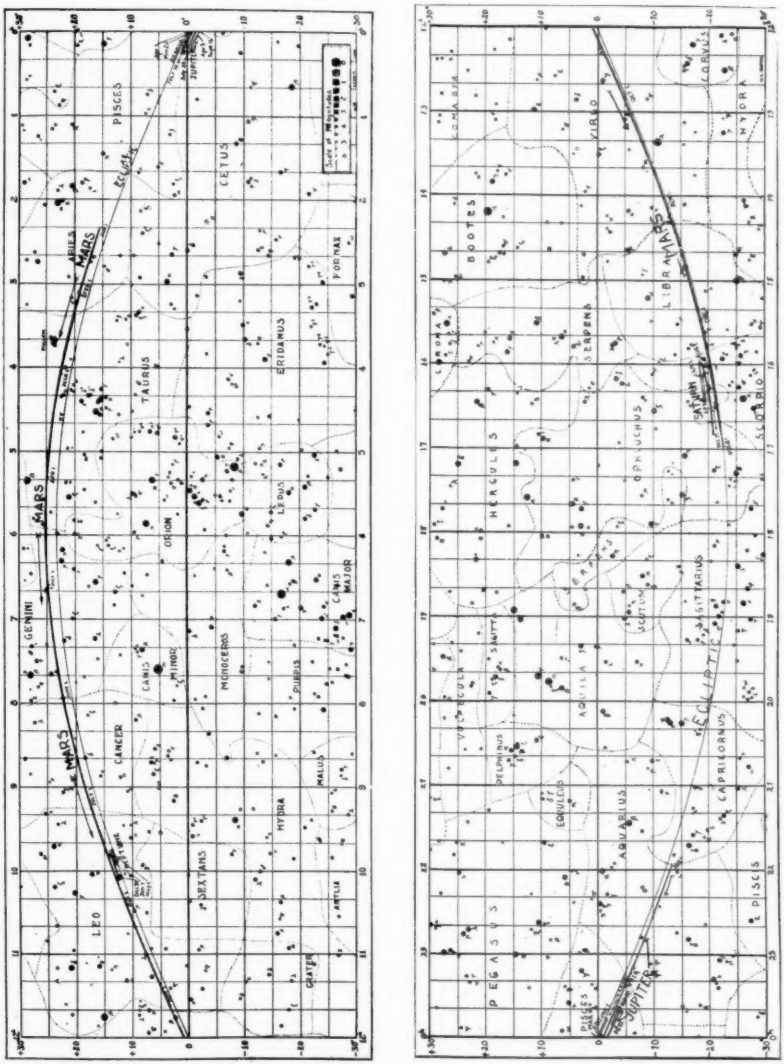


FIG. 4.

Apparent paths of the planets Mars, Jupiter, Saturn, Uranus and Neptune among the stars during the year 1927.

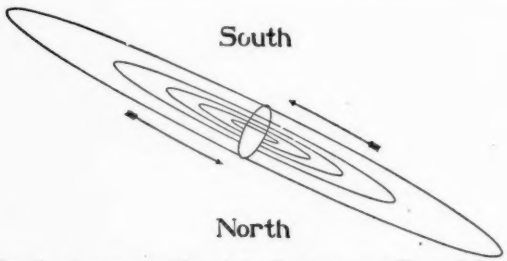


FIG. 5. Apparent orbits of the five inner satellites of Jupiter at the date of opposition, September 22.

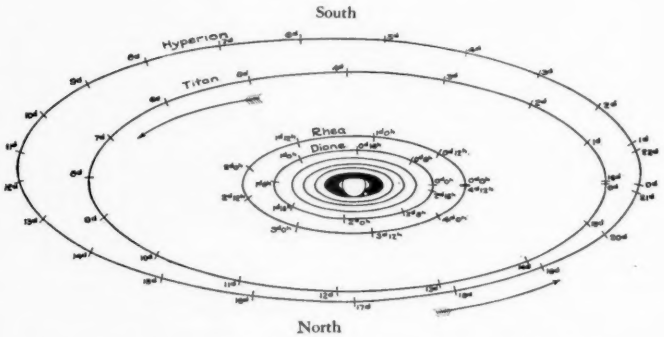


FIG. 6. Apparent orbits of the seven inner satellites of Saturn at date of opposition, May 26.

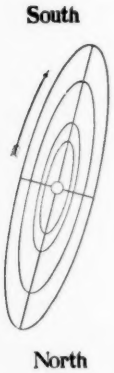


FIG. 7. Apparent orbits of the satellites of Uranus at date of opposition, Sept. 25.

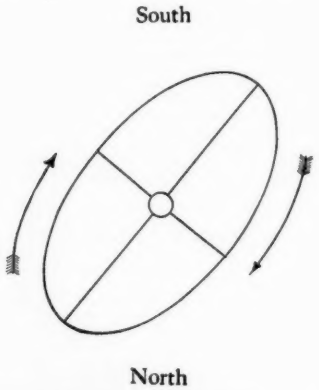


FIG. 8. Apparent orbit of the satellite of Neptune at date of opposition, February 15.

SATELLITES.

As heretofore we shall publish the configurations of the satellites of Jupiter and Saturn when these planets are in suitable position for observation.

COMETS.

Six periodic comets may be expected to return this year. They are Neujmin, Grigg-Skjellerup, Pons-Winnecke, Schaumasse, Encke, and Holmes. According to ephemerides in the Handbook of the British Astronomical Association these are due at perihelion in January, May, June and November, 1927, and February and March 1928, respectively. Comet Neujmin has already been rediscovered as noted on page 641 of the December issue. Ephemerides will be published later.

We have been fortunate in securing Prof. Van Biesbroeck to write the comet notes for the last few issues and hope he will be able to continue this valuable contribution.

OCCULTATIONS.

No bright stars will be occulted by the moon this year but Venus, Mars, and Saturn will all be occulted two or more times. We hope to publish charts by Father Rigge for those visible in the United States. We shall also give those occultations visible at Washington as found in the *American Ephemeris*.

PLANET NOTES FOR FEBRUARY.

By CLIFFORD E. SMITH.

The *Sun*, at the beginning of the month, will be midway in Capricornus. Its position will be R.A. $20^h\ 54^m\ 21^s.2$, Decl. $-17°\ 26'\ 28''$. About the 18th of the month the sun will enter Aquarius, and during the remainder of the month it will partly cross that constellation, moving northeast. The position of the sun at the end of the month will be R.A. $22^h\ 40^m\ 9^s.7$, Decl. $-8°\ 25'\ 21''$.

The phases of the *Moon* will occur as follows:

New Moon	Feb.	2 at	3 A.M.	C.S.T.
First Quarter		8 "	6 P.M.	"
Full Moon		16 "	10 A.M.	"
Last Quarter		24 "	3 P.M.	"

The moon will be at perigee (nearest the earth) on February 4, and at apogee (farthest from the earth) on February 19.

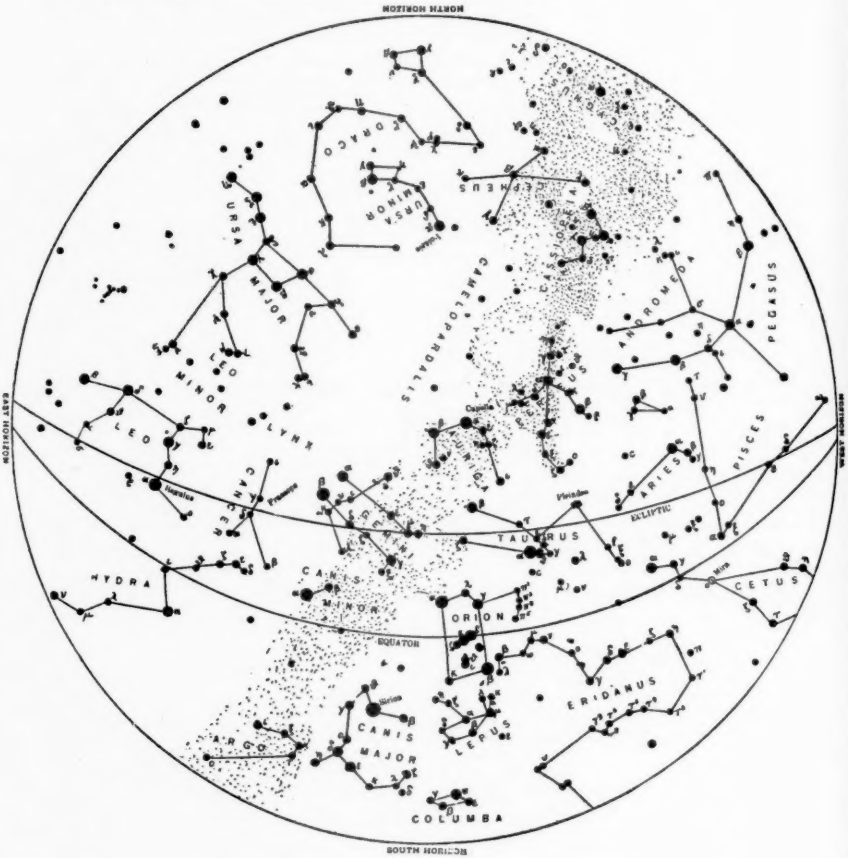
Mercury, on February 1, will be near the sun in Capricornus. During the month it will cross Aquarius and part of Pisces. Mercury will be moving east from the sun toward greatest elongation which will occur on February 25. At that time Mercury will set about an hour after the sun; thus it will be visible to the unaided eye only for a short time after sunset during that part of the month.

Venus will be near the western edge of Aquarius on February 1. During the month it will cross Aquarius and Pisces a few degrees ahead of Mercury. On March 1 Venus will be about 7 degrees east of Mercury, and it will set about an hour and a half after sunset.

Mars will be in the eastern part of Aries, but early in the month it will cross over into Taurus. On February 18 it will be only about 2½ degrees south of the Pleiades, and it will set about 5½ hours after the sun.

Jupiter will continue to move toward the sun during the month. Conjunction will occur early in March so that the apparent position of Jupiter at the end of the month will be nearly the same as that of the sun.

Saturn, during February, will be about 6 hours west of the sun in the western part of Ophiuchus. Saturn will be in quadrature with the sun on February 17, and it will rise about midnight during that part of the month.



THE CONSTELLATIONS AT 9:00 P. M. FEBRUARY 1.

Uranus will be visible in the early evening in Pisces. At the end of the month Uranus will be about 2½ degrees east of Mercury. It will be remembered that Venus is also in this same region of the sky at this time (7 degrees east of Mercury).

Neptune will be in Leo just west of α Leonis, and it will be in a position very favorable for observation. It will be in opposition on February 15.

Occultations Visible at Washington.
[From the *American Ephemeris.*]

Date 1927		Star's Name	Magnitude	IMMERSION. Washington C.T.	IMMERSION. Angle from N	EMERSION. Washington C.T.	EMERSION. Angle from N	Duration
				h m	°	h m	°	h m
Feb.	6	117 G. Piscium	6.5	18 16	15	19 9	282	0 53
	7	389 B. Ceti	6.3	23 16	119	23 44	206	0 38
	9	180 B. Tauri	6.1	17 9	128	17 45	182	0 36
	11	141 Tauri	6.3	18 17	100	19 35	235	1 18
	12	η Gemin.	3.2	2 9	108	3 6	260	0 57
	14	μ Cancri	5.5	3 44	103	4 42	287	0 58
	21	80 Virginis	5.6	2 54	128	4 23	303	1 29
	27	26 Sagittarii	6.1	3 38	34	4 5	346	0 27

COMET NOTES.

By G. VAN BIESBROECK.

Of the different comets that are now under observation only two are in reach of instruments of medium size.

a) Periodic Comet 1926 *e* (Giacobini-Zinner). Well situated in the evening sky this comet has been observed here several times during the last month. It has now reached its maximum brightness of 11^M and will begin to decline in January. On December 20 it was situated at only 50′ from the planet Jupiter. The following ephemeris continued from the November issue (p. 599) indicates the motion during the coming months:

0^h U.T. 1927	α h m	δ ° ′	Log. Δ	Log. r	Mag.
Jan. 4	23 2.4	—16 29	0.061	0.021	11.4
12	23 43.2	—16 38			
20	0 22.3	—16 14	0.089	0.058	11.7
28	0 59.1	—15 24			
Feb. 5	1 33.5	—14 14	0.131	0.102	12.2
13	2 5.6	—12 51			
21	2 35.3	—11 20	0.181	0.147	12.6
Mar. 1	3 3.1	— 9 46			
9	3 28.8	— 8 16	0.233	0.190	13.1
17	3 53.4	— 6 48			

The brightness has been adjusted so as to represent the December estimations.

b) Comet 1926 *f* (Comas Solá). This comet has now been followed for nearly two months. As expected it has not changed much in brightness. Large deviations from the preliminary parabolic orbit were shown and various computers found that the orbit is clearly elliptical. The following sets of elements show the range of uncertainty; the first elements are deduced from observations on Nov. 7, 15, and 28; the second from three other dates Nov. 6, 12, and 30. In both cases the residuals are not larger than 1″.

	A Equinox 1926.0	B Equinox 1926.0	C Equinox 1890
Perihelion U.T.	1927 Mar. 21.3137	1927 Mar. 21.1871	1890 Oct. 27.0222
Longitude of perihelion	38° 9′ 25″4	38° 19′ 51″	13° 19′ 13″
Node	65 44 55.4	65 45 43	45 4 57
Inclination	13 38 4.8	13 37 21	12 50 7
Eccentricity	0.57067	0.57669	0.6865
Perihelion distance	1.76862	1.76366	1.81733
Semi major-axis	4.11949	4.16637	3.4373
Period in years	8.36	8.504	6.373

Elements A are by A. C. Crommelin in Copenhagen Circular No. 127 and elements B by L. E. Cunningham in Harvard Observatory Card No. 13. Elements C are those of Comet Spitaler. Both computers suspect identity of comet *f* with 1890 VII Spitaler, a peirodic comet that has been observed only at its first apparition.

I have used the second set of elements for computing the following ephemeris for January:

EPHEMERIS OF COMET COMAS SOLÁ 1926 *f* (Elements Cunningham).

0^h U.T. 1927	α h m s	δ ° ′	Log. Δ	Log. *r*	Mag.
Jan. 1	2 23 0	+13 47.9	0.097	0.284	11.7
5	24 33.	14 36.3			
9	26 42	15 26.2	0.113	0.278	11.7
13	29 29	16 17.1			
17	32 51	17 9.1	0.130	0.271	11.8
21	36 48	18 2.0			
25	41 17	18 55.3	0.147	0.266	11.8
29	46 19	19 49.3			
Feb. 2	51 53	20 43.7	0.164	0.261	11.9
6	2 57 57	+21 37.6			

The magnitude is computed by adopting 12^M as the brightness at discovery. It will be seen that owing to the increasing distance from the earth the light of the comet is already fading.

In the beginning of January the comet, moving slowly through the constellation of Aries will be at an angular distance of only one degree from the planet Mars.

Aside from these two relatively bright comets several faint ones are in reach of larger instruments. COMETS 1925 *a* (SHAJN) and 1925 *b* (REID) were again photographed here as faint nebulosities, the brightness of which is equivalent to stars of magnitude 15 and 16.5 respectively. COMET 1926 *g* (NEUJMIN) now hardly brighter than 15^M, is moving rapidly southward. The continuation of the ephemeris of last month is as follows:

0^h U.T. 1927	α h m	δ ° ′	Log. Δ	Log. *r*	Mag.
Jan. 3	13 1.0	— 6 58	0.008	0.131	14.6
11	23.5	—10 56			
19	45.7	—14 51	9.975	0.128	14.4
27	14 7.2	—18 38			
Feb. 4	27.9	—22 15	9.950	0.133	14.3
12	47.7	—25 39			
20	15 5.8	—28 47	9.921	0.145	14.3
28	22.1	—31 40			
Mar. 8	35.9	—34 16	9.913	0.162	14.3
16	46.9	—36 36			
24	54.7	—38 37	9.900	0.183	14.3
Apr. 1	15 58.8	—40 21			

Perihelion falls on Jan. 16, but there is a slight increase in brightness after that date owing to the decreased distance from the earth. The comet stays a morning object and crosses the constellations of Virgo and Libra during January and February.

Both COMETS 1926 *c* (KOPFF) and 1926 *d* (FINLAY) are now beyond the limit of visibility for our instruments.

In the coming months the return of two periodic comets is expected. Merton has established the identity of COMETS 1922 I (SKJELLERUP) and 1902 II (GRIGG).

The period is only five years and the object will probably be picked up in February or March. According to an ephemeris by Merton the expected magnitude is only 17^M in January so that there is not much hope of recording the object as early as this month.

The other expected periodic comet is Pons-Winnecke's which will probably become quite conspicuous during the summer months.

In Circular 19 of the Tokyo Observatory S. Kanda gives an ephemeris for the present opposition of COMET 1925 *g* (BROOKS) which was last observed at Bergedorf on 1926 March 15. Since the computed brightness is however of about 17^M it is doubtful if it will be observed at all.

Yerkes Observatory, Williams Bay, Wis., Dec. 22, 1926.

METEOR NOTES.

By CHARLES P. OLIVIER.

The most interesting set of observations that were made by any member of the American Meteor Society in 1926 and that have so far been reported are those on the Perseids by Dr. H. L. Alden, now in charge of the Yale Observatory Southern Station at Johannesburg, South Africa. These observations were made on Aug. 11 from 2:18 to 5:48 A.M., and Aug. 12 from 2:35 to 5:00 A.M., S.A. time, the sky being clear on both nights. On the first night 48 meteors were recorded, 5 being Perseids and one possible Perseid; on the second 37 meteors, 4 being Perseids and one possible Perseid.

The greatest interest in these observations lies in the fact that at Johannesburg the Perseid radiant, according to Alden's computations, rises only $2^h\,45^m$ before its meridian passage in azimuth 22°N of E. It rose Aug. 11 at 3:12 A.M.; on Aug. 12 at 3:08 A.M. Three Perseids hence were seen 32, 31, and 2 minutes before the radiant was upon the true horizon, according to the record sheets. Alden further states that the Perseids seemed to start rather slowly gaining brightness and angular speed as they rose. One in particular, No. 67, at 3:33 on Aug. 12, of 0 magnitude, was seen through an arc of 150°, duration 8.0 seconds and train 2.0 seconds. It was finally lost behind trees. Most of the other Perseids were recorded as of magnitude 3. The average hourly rate for all meteors on the two nights was 14. Some Perseids, he writes, were said to have been seen on two previous mornings at the Union Observatory, Johannesburg. All the above details are taken from the complete reports sent to the A.M.S. and the accompanying letter.

From Alden's maps the writer has derived 4 radiants. As none of them depends upon many meteors, and all the 85 meteors were seen within a space of 27 hours, during same hours of the two nights, it has seemed best to combine the work of the two nights as of the mean date.

We then find:

	α	δ	Nos.
Aug. 11-12	45°.0	56°.9	8 Perseids
Aug. 11	30.5	10.2	3-4
Aug. 11-12	57.3	0.3	3
Aug. 11	359.	39.	3

Dr. Alden is to be congratulated on being the first person, so far as the writer knows, ever to determine an accurate Perseid radiant when so far as 26° south. His success indicates that a harvest of interesting results awaits the first trained observer in the Southern Hemisphere who can turn a major part of his time to meteoric astronomy.

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1927					
					February					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8	6 7					
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	5 8	13 0	20 16	28 8		
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	5 6	12 17	20 5	27 16		
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	4 15	10 18	16 20	22 23		
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	7 0	15 14	24 3			
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	1 23	8 20	15 17	22 13		
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	6 6	13 11	20 15	27 19		
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	9 17	18 12	27 7			
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	3 17	11 16	19 15	27 13		
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6						
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	2 3	10 18	19 8	27 23		
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	3 17	10 12	17 7	24 3		
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	2 19	10 17	18 15	26 12		
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	6 15	14 22	23 5			
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	1 15	9 13	17 10	25 7		
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	3 9	16 14	29 19			
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	5 12	11 19	18 3	24 10		
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	4 3	16 13	28 23			
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	1 1	7 16	21 0	27 16		
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	7 8	15 12	23 16			
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	2 1	8 2	20 3	26 3		
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	3 20	12 12	21 4			
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	8 11	13 16	18 21	24 2		
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	8 10	16 10	24 10			
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	4 18	10 12	21 23	27 16		
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	1 22	7 12	18 17	24 8		
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	5 17	13 22	22 3			
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	4 17	12 8	19 23	27 14		
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	5 6		17 11			
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	2 5	9 9	16 13	23 17		
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	6 17	13 13	20 8	27 4		
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	4 19	14 1	23 10			
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	2 19	9 6	15 21	22 11		
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	2 6	10 15	19 1	27 11		
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	5 21	12 7	18 18	25 1		
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	7 10	14 17	21 23			
X Carinæ	8 29.1	—58 53	7.9— 8.7	0 13.0	7 15	15 18	23 20			
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	9 6	18 18	28 5			
RX Hydræ	9 00.8	— 7 52	9.1—10.5	2 06.8	7 14	14 11	21 7	28 3		
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	6 21	12 19	18 18	24 16		
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	1 23	8 17	22 5	28 23		
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	7 20	15 6	22 16			
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	2 22	9 12	16 3	22 17		
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	5 12	14 8	23 3			
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	4 14	11 22	19 6	26 14		
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	6 8	13 2	19 21	26 16		
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	2 5	9 17	17 5	24 18		
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	1 17	11 7	20 22			
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	3 6	10 16	18 3	25 13		

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1927							
					February							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Hydræ	13 39.0	−26 23	8.6—12.7	2 21.5	8 8	17 1	25 19					
δ Libræ	14 55.6	— 8 07	4.8— 6.2	2 07.9	7 12	14 12	21 11	28 11				
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	4 10	11 8	18 6	25 3				
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4	9 8	17 18	26 4					
SS Libræ	15 43.4	−15 14	9.3—11.5	0 18.4	6 1	13 5	20 10	27 14				
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	2 18	10 2	17 10	24 18				
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	3 18	12 0	20 6	28 12				
R Aræ	31.1	−56 48	6.8— 7.9	4 10.2	8 0	17 4	26 0					
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1	7 19			28 13				
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	5 23	11 16	18 10	25 6				
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	1 16.2	2 10	10 18	19 4	27 13				
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	5 9	11 12	17 16	23 20				
TX Herculis	15.4	+42 00	8.3— 9.0	2 01.4	4 13	10 18	16 22	23 2				
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	7 16	15 1	22 10					
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	6 19	15 0	23 4					
TX Scorpii	48.6	−34 13	7.5— 8.2	0 22.6	6 15	14 4	21 17					
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	6 11	14 5	21 23					
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	5 12	13 11	21 11	29 11				
WX Sagittarii	53.6	−17 24	9.2—10.8	2 03.1	2 0	9 13	18 1	26 14				
WY Sagittarii	17 54.9	−23 01	9.5—10.6	4 16.0	2 2	11 10	16 2	25 10				
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	6 2	11 6	21 14	26 18				
RS Sagittarii	11.0	−34 08	5.9— 6.3	2 10.0	1 11	8 17	15 23	23 5				
V Serpentis	11.1	−15 34	9.5—11.1	3 10.9	3 7	10 5	17 3	25 0				
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2		18 23		24 2				
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	5 6	12 10	19 14	26 18				
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	4 13	11 16	18 18	25 21				
SX Sagittarii	39.7	−30 36	8.7— 9.8	2 01.8	7 2	15 9	23 16					
RR Draconis	40.8	+62 34	9.3—13	2 19.9	5 11	13 23	22 11					
RS Scuti	43.7	−10 21	9.3—10.3	0 15.9	6 15	13 6	19 21	26 13				
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8		11 11		24 8				
U Scuti	18 48.9	−12 44	9.1— 9.6	0 22.9	1 12	9 3	16 18	24 10				
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	8 9	15 23	23 12					
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	3 10	10 15	17 20	25 1				
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	3 15	11 14	20 13					
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	4 10	11 4	17 23	24 17				
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	6 23	14 8	21 17					
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	2 8	12 20	18 2	28 11				
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	4 17	11 6	17 19	24 7				
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	2 15	8 16	20 16	26 16				
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	2 13	9 2	22 8	28 23				
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	4 8	13 12	18 2	27 5				
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	2 8	10 18	19 4	27 15				
RW Capric.	12.2	−17 59	8.8—10.6	3 09.4	3 8	10 3	16 22	23 17				
UW Cygni	19.6	+42 55	10.5—13	3 10.8	3 0	9 22	16 19	23 17				
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0	2 15							
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	5 0	9 19	19 10	24 5				
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	1 0	10 5	19 10	28 14				
Y Cygni	48.1	+34 17	7.1— 7.9	2 23.9	2 22	11 21	20 21					
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	4 18	12 8	19 23	27 13				
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	2 7	12 10	22 12					
RY Aquarii	21 14.8	−11 14	8.8—10.4	1 23.2	6 8	14 5	22 1					
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3	4 16							
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	1 12	11 16	16 18	26 21				
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	4 1	9 5	19 14	24 19				
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	5 5	10 12	21 1	26 7				
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	7 18	15 7	22 20					
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	4 23	13 5	21 11					

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5h; Central Standard time 6h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1927							
					February							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7					22 0			
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	2 5	10 8	18 12	26 15				
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	6 1	13 18	21 12					
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2	9 20		24 15					
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	7 5	15 4	23 2					
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	2 1	9 20	17 16	25 11				
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0		15 4						
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	4 0	12 14	21 4					
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	8 4		19 7					
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0	7 19		19 10					
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	3 19	11 11	19 3	26 18				
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3	7 21		18 0	28 3				
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	3 5	10 22	18 15	26 9				
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	3 23	9 12	20 13	26 2				
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	6 13	14 3	21 16					
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3		10 11						
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	1 10	8 21	16 8	23 19				
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	7 5		15 3	23 1				
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	3 4	13 8		23 12				
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5	13 2							
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	8 11		16 10	24 9				
V Carinæ	8 26.7	—59 47	7.4— 8.1	6 16.7	3 23	10 3	17 8	24 1				
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	2 1	11 8	15 23	25 6				
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	5 21	14 14		23 8				
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7				24 10				
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	3 10	10 5	17 0	23 19				
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	1 0	7 15	20 20	27 10				
S Muscæ	12 07.4	—69 36	6.4— 7.3	9 15.8	6 11	16 3	25 18					
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	1 21	9 20	17 19	25 19				
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	6 10	13 4	19 21	26 15				
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	6 12	12 7	18 3	23 23				
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	1 17	11 2	15 19	25 4				
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5	7 10		24 16					
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	3 3	11 8	19 12	27 17				
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	5 22	12 22	19 23	26 23				
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	3 15	11 1	18 10	25 20				
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	3 3	8 14	19 14	25 2				
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	3 16	11 5	18 18	26 7				
R Trian.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	6 20	13 15	20 10	27 5				
S Trian.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	1 6	7 13	20 5	26 13				
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	7 0	16 18	26 12					
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	8 2	16 21	25 6					
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	2 0	8 1	20 4	26 6				
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	2 3	9 3	16 4	23 4				
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9		13 4						
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	7 21	15 11	23 1					
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	3 2	8 21	20 10	26 4				
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	5 22	12 16	19 10	26 3				
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	4 3	14 11	24 19					
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	3 19	11 11	19 4	26 20				
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	6 20	14 7	21 17					
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	9 15	18 18	27 20					
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	1 22	8 23	15 23	23 0				
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	7 4	14 4	21 4	28 4				

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1927 February					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	5 22	13 22	21 21			
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	5 5	12 21	20 14	28 7		
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	5 17	12 21	20 1	27 6		
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	5 4	13 13	21 23			
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	2 16	8 23	21 15	27 23		
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	9 16		26 2			
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	5 1	13 22	22 19			
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	1 18	9 1	16 7	23 14		
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	7 11	14 15	21 19	28 22		
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	13 0		27 17			
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	2 11	10 8	18 4	26 1		
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	6 6	13 3	20 0	26 22		
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7		10 11	20 4			
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	5 13	14 4	22 20			
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	2 5	7 13	18 7	23 16		
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1		11 10	22 7			
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	5 2	11 11	17 21	24 7		
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	2 17	12 16	22 15			
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	5 20	11 6	22 4	27 14		
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	2 8	7 19	18 16	24 2		
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	2 13	8 20	21 11	27 18		
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4	3 14	15 17	27 20			
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	6 4	13 3	20 3	27 2		

Monthly Report of the American Association of Variable Star Observers, for the month ending November 30, 1926.

Beginning with this issue, we adopt a new form for publishing our observations. This method of expressing the results of our work has been arrived at only after due consideration and consultation with many of our observers, as well as with professional astronomers who use our results so thoroughly. While this form does not entirely compass the desire to put the greatest amount of data into the least possible space, it does overcome the difficulty in a great measure, and appears to be that which will best satisfy the majority of our members, and at the same time accomplish the desired result.

For the irregular variables whose light changes are at times quite rapid, a supplementary table has been inserted, giving the decimal of a day to tenths. It seems hardly necessary to continue printing the tenth of a day for the long period variables, although observers are requested to continue to report the decimal of the day as usual, referring the same to the Greenwich Mean Noon of the civil day of observation—as has been done in years past, except for 1925.

Attention is called to the observations by several new observers, Messrs. Bappu, Bhaskaran, Cherrington, Kukarkin, Logan, and Vorontsov-Velyaminov. It is also good to see the name of Pickering—D. B.—among those who have contributed to this month's list.

It is with deep regret that we record the passing of two of our members during the past month. Mr. Paul W. Slifer, of Harrisburg, Pa., met death in an auto accident on November 15, and Mr. John J. Crane, of Sandwich, Mass., died on November 29. Mr. Slifer had only recently joined our ranks, but he had displayed a keen interest in our work, and had he lived, doubtless would have played

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1926.

Sept. 0 = J.D. 2424759; Oct. 0 = J.D. 2424789; Nov. 0 = J.D. 2424820.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
		V Scl			S Tuc			W Cas			R Ari			o Cet			R Hor
		000339			*001862*			004958			021024			*021403*			*025050*
761	[	13.8	Bl	761	[	13.5	Bl	867		9.1	B	823		10.0	O	823		3.8	Ie	788		10.3	Bl
		S Scl		763	[	13.2	Sm			U Tuc		830		9.8	Lv	824		3.5	Jo			T Hor	
		001032		774		11.9	Sm			*005475*		831		9.8	Ms	825		4.1	Ms			*025751*	
761		8.9	Bl			S Cet		761	[	13.8	Bl			W And		825		3.6	Pt	761		10.3	Bl
763		9.1	Ht			*001909*		763		12.9	Sm			021143a		826		4.0	Ms	763		9.9	Sm
763		8.8	Sm	802		12.0	L			Z Cet		815	[	11.9	Bx	826		3.5	Wa	774		9.1	Sm
768		8.8	Ht	803		11.7	L			*010102*		820		12.8	Pt	829		3.7	Wa	777		9.3	Bl
769		8.5	En	820		13.5	Pt	820		9.0	Pt	823		13.0	Ie	830		3.4	Ms	788		9.3	Bl
774		8.8	Sm	823		12.2	Ie			U Scl				T Per		831		3.6	Jo			U Ari	
775		8.8	Ht			T Phe				*010630*				021258		831		3.5	Hu			030514	
777		8.5	Bl			*002546*		761		9.9	Bl	801		8.7	Ch	831		3.6	Ms	761		12.7	Bf
786		8.5	En	761		9.8	Bl	777		9.9	Bl	825		8.4	Pt	832		3.7	Ms	780		13.2	Bf
787		8.2	Ht	763		9.8	Sm	788		10.1	Bl			Z Cep		833		3.6	Ms	814		14.8	Bf
788		8.5	Bl	774		10.2	Sm			UZ And				021281		835		3.5	Ms	815		14.4	Bf
802		7.5	Kd	777		10.4	Bl			011041		803	[	13.0	B	839		3.8	Ms			X Cet	
		X And		788		11.1	Bl	831		13.7	Ie	826		8.0	Hu			S Per				*031401*	
		001046				W Scl				S Cas				o Cet				021558		791		11.9	L
765		9.7	Bg			*002833*				011272				*021403*		799		9.1	Kl	802		11.4	L
780		10.1	Bf	761		13.0	Bl	807		11.7	B	739		7.5	Kd	807		8.6	Ch	825		9.6	Pt
793		10.4	Bg			Y Cep		815		11.8	Px	741		7.5	Kd	812		9.1	Kl			Y Per	
797		10.7	Bf			003179		820		10.2	Pt	763		6.8	Kd	821		8.4	Lp			032043	
801		10.8	Ch	826		9.9	Hu	831		10.6	Ie	763		7.0	Ku	821		8.3	Ms	793		8.8	Gb
806		10.7	Bf			U Cas				R Psc		770		6.6	Ku	825		8.1	Pt	815		8.6	Bx
808		11.3	Ie			004047				012502		771		5.6	Ku	826		7.9	Hu	825		9.0	Pt
810		10.6	Bf	832		12.2	Pi	765		13.6	Bg	772		5.4	Ku			R For		828		8.1	Hu
814		10.9	Bf			RX Cep		803		13.8	Bf	779		4.8	Ku			*022426*		828		9.6	O
817		11.7	Lv			004281		814		13.7	Bf	781		4.4	Ku	761		10.3	Bl			R Per	
818		11.1	Bf	774		7.8	Ku	816		13.6	Bf	784		4.1	Ku	777		9.6	Bl			032335	
825		12.5	Hu	787		7.7	Ku	819		13.5	Bf	785		3.9	Ch	788		10.2	Bl	821		11.3	Lp
828		12.2	Pi	788		7.8	Ku	830		13.3	Lv	787		4.0	Ku			U Cet		823		11.0	Ie
		T Cet		789		7.5	Ku			RU And		788		4.0	Ku			*022813*		825		10.4	Pt
		001620				V And				013238		788		3.8	Kd	802		7.6	Ch	827		11.0	Gs
791		5.9	L			004435		788		11.0	Ch	789		3.6	Ch	825		8.3	Pt			T Tau	
803		5.8	L	761		11.5	Bf	807		11.0	B	789		3.8	Ku			RR Cep				041619	
		T And		765		11.5	Bg	815		12.1	Bx	791		3.7	Kd			022980		761		10.4	Bf
		001726		780		12.7	Bf	820		11.0	Ch	791		3.3	L	825		9.6	Pt			R Tau	
823	[	12.6	Ie	793		14.2	Bg	831		12.4	Ie	792		3.7	Kd			R Tri				042209	
		T Cas		797		14.3	Bf			Y And		793		3.7	Kd			023133		761		14.7	Bf
		001755		803		14.7	Bf			013338		793		3.2	Gs	815		12.0	Bx	796		14.8	Bg
791		11.9	L	811		15.2	Bf	788		10.4	Ch	796		3.6	Ch	825		11.8	Pt	802		14.3	Bg
805		11.9	L	814		14.7	Bf	807		11.1	B	799		3.4	Ch	828		12.5	Hu	816		14.4	Bf
807		11.4	B	816		15.0	Bf	815		11.6	Bx	799		3.1	Gs	828		11.8	O	819		14.3	Bf
815		11.5	Bx	818		15.0	Bf	820		12.1	Pt	801		3.1	Gs			W Per				W Tau	
818		11.6	Al	830	[	13.4	Lv			X Cas		802		3.4	Kd			024356				042215	
820		11.8	Pt			X Scl				014958		802		3.0	L	808		9.3	Bx	825		10.2	Jo
821		11.5	Ie			*004435*		807		10.7	B	802		3.4	Ch	825		9.2	Pt	825		9.8	Pt
832		11.3	Pi	761		13.2	Bl	820		11.5	Pt	802		2.9	Gs	826		9.0	Hu	831		9.9	Hu
		R And				RV Cas				U Per		803		2.9	Gs	828		9.7	O			S Tau	
		001838				004746a				015254		805		3.2	Ch	831		9.2	Bx			042309	
788		9.6	Ch	820		13.0	Pt	793		8.8	Gb	806		3.4	Kd			R Hor		761		12.8	Bf
801		10.2	Ch			—	Cas	820		9.1	Pt	806		3.1	Be			*025050*		796		14.6	Bg
815		11.1	Bx			004746b		826		9.0	Hu	807		2.9	Gs	761		10.9	Bl	802		14.9	Bg
815		10.5	Jo	820		10.8	Pt	828		9.5	O	808		3.3	Kd	763		11.8	Sm	816		14.9	Bf
820		10.8	Pt			W Cas				R Ari		814		3.5	Wa	763		11.5	Ht	819		15.0	Bf
821		10.3	Lp			004958				021024		815		3.0	Jo	768		11.5	Ht			T Cam	
823		11.2	Ie	820		9.0	Pt	797		12.3	Ch	816		3.5	Lp	774		11.8	Sm			043065	
832		11.8	Pi	821		10.0	Lp	820		10.5	Pt	816		3.1	Be	777		10.3	Bl	802		9.6	L
				826		10.0	Hu	821		10.4	Lp	817		3.3	Wa	787		11.0	Ht	825		11.0	Pt
				832		10.2	Pi	821		10.3	Ms	821		3.6	Lp	787		10.9	En				

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1926—Continued.

J.D.Est.Obs.

R RET
043263
761 10.7 Bl
763 11.0 Ht
763 10.7 Sm
765 11.0 En
769 11.0 En
774 11.4 Sm
777 11.6 Bl
786 11.4 En
787 12.0 Ht
X CAM
043274
820 10.0 Gs
825 9.4 Pt
R DOR
043562
761 5.6 Bl
763 5.8 Sm
763 5.5 Ht
765 5.8 En
769 6.0 En
774 5.8 Sm
777 5.5 Bl
786 5.6 En
787 5.5 Ht
788 5.5 Bl
R CAE
043738
763 11.5 Ht
787 11.7 Ht
788 11.8 Bl
R PIC
044349
761 6.5 Bl
777 7.0 Bl
788 7.1 Bl
V TAU
044617
797 11.8 Ch
R LEP
045514
791 9.0 L
800 10.3 Ch
802 9.2 L
825 9.0 Pt
V ORI
050003
825 13.6 Pt
T LEP
050022
788 11.6 Bl
825 11.3 Pt
S PIC
050848
788 13.0 Bl
R AUR
050953
797 8.4 Ch
820 8.5 Gs
826 8.5 Pt

J.D.Est.Obs.

T PIC
051247
787 10.2 Ht
788 10.0 Bl
T COL
050533
787 7.2 Ht
788 6.7 Bl
S AUR
052034
802 9.5 Ch
826 9.3 Pt
W AUR
052036
802 9.0 Ch
824 9.0 Gs
826 9.6 Pt
831 9.5 Hu
S ORI
052404
825 10.3 Pt
T ORI
053005a
805 10.2 L
806 9.9 L
825 10.5 Pt
826 10.6 Pt
830 9.8 Pt
831 9.7 Pt
836 10.6 Pt
S CAM
053068
825 8.7 Pt
RR TAU
053326
761 10.8 Bf
796 10.6 Bg
802 10.8 Bg
819 10.7 Bf
RU AUR
053337
825 10.0 Pt
U AUR
053531
802 8.4 Ch
825 7.9 Pt
SU TAU
054319
791 9.7 L
797 9.8 Ch
805 9.7 L
815 9.6 Pt
821 9.8 Ie
825 9.6 Pt
826 9.6 Pt
830 9.5 Pt
831 9.5 Hu
831 9.5 Pt
836 9.5 Pt
S COL
054331
788[13.1 Bl

J.D.Est.Obs.

Z TAU
054615a
802 13.8 Bg
811 14.0 Bg
RU TAU
054615c
802 12.8 Bg
819 13.1 Bg
821 13.5 Ie
R COL
054629
788[13.0 Bl
U ORI
054920a
738 8.5 Kd
764 6.8 Kd
792 6.5 Kd
808 6.9 Kd
821 7.0 Lp
824 7.4 Gs
825 7.6 Pt
831 7.8 Gb
Z AUR
055353
802 9.8 Ch
810 9.9 Pt
815 9.4 Pt
816 9.4 Pt
820 9.4 Pt
824 9.4 Pt
825 9.3 Pt
826 9.5 Pt
827 9.5 Pt
830 9.8 Pt
831 9.8 Pt
836 9.7 Pt
X AUR
060450
797 11.0 Ch
802 11.5 Ch
830 11.4 Pt
V MON
061702
825 9.9 Pt
R MON
063308
825 10.5 Pt
NOV. PIC
063462
787 6.2 Ht
S LYN
063558
830 12.4 Pt
W MON
064707
825 9.3 Pt
Y MON
065511
825 13.1 Pt
X MON
065208
791 8.3 L

J.D.Est.Obs.

X MON
065208
802 8.1 L
808 8.2 L
R LYN
065355
830 10.8 Pt
R GEM
070122a
804 9.9 Ch
825 7.8 Pt
826 7.9 Al
TW GEM
070122b
825 8.0 Pt
Z GEM
070122c
825 12.5 Pt
R CMI
070310
791 7.7 L
805 7.5 L
R VOL
070772
787[12.6 Ht
V GEM
071713
825 8.6 Pt
S CMI
072708
791 11.1 L
805 10.6 L
825 9.9 Pt
U CMI
073508
791 11.4 L
805 11.8 L
825 13.0 Pt
S GEM
073723
792 11.7 Kd
825 8.7 Pt
T GEM
074323
825 8.8 Pt
R CNC
081112
791 11.8 Pt
805 11.3 L
825 11.8 Pt
V CNC
081617
804 11.2 Ch
825 12.1 Pt
RT HYA
082405
825 8.2 Pt
R CHA
082476
760 12.1 Bl

J.D.Est.Obs.

X UMA
083350
825 11.9 Pt
S HYA
084803
825 12.6 Pt
T HYA
085008
825 11.7 Pt
T CNC
085120
825 11.7 Pt
V UMA
090151
728 6.0 Ku
732 6.0 Ku
751 6.0 Ku
756 6.2 Ku
763 6.4 Ku
R CAR
092062
760 6.1 Bl
768 6.2 Bl
787 6.7 Bl
X HYA
093014
808 9.0 Bg
819 8.2 Bg
825 8.0 Pt
R LMI
093934
825 12.1 Pt
R LEO
094211
115058
792 9.6 Kd
804 9.0 Ch
825 7.8 Pt
X LEO
094512
806[13.5 L
Y HYA
094622
825 6.6 Pt
V LEO
095421
825 13.7 Pt
RV CAR
095563
785[13.1 Bl
S CAR
100661
760 5.0 Bl
763 6.0 Sm
768 5.0 Bl
787 5.6 Bl
U HYA
103212
808 6.0 Kd
R UMA
103769
751 8.4 Ku
759 8.2 Ku

J.D.Est.Obs.

R UMA
103769
770 8.0 Ku
772 7.8 Ku
779 7.8 Ku
787 8.1 Ku
788 8.2 Ku
789 8.2 Ku
804 8.1 Ch
825 8.8 Pt
W HYA
104620
825 8.6 Pt
RS CAR
110361
763[12.1 Sm
S LEO
110506
825 11.3 Pt
RY CAR
111561
788[13.1 Bl
RS CEN
111661
760 11.4 Bl
763 11.6 Sm
768 11.8 Bl
788 12.9 Bl
X CEN
114441
760 10.7 Bl
768 11.0 Bl
W CEN
115058
765[12.2 En
788 12.5 Bl
SU VIR
120012
825 12.3 Pt
T CVN
122532
825 9.5 Pt
U CEN
122854
760 8.4 Bl
768 7.6 Bl
787 9.3 Bl
T UMA
123160
794 11.2 Kl
799 10.5 Kl
806 10.3 Kl
810 9.8 Kl
812 9.8 Kl
816 9.0 Kl
819 8.7 Kl
821 8.6 Lp
825 8.0 Pt
R VIR
123307
825 6.5 Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1926—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RS UMa	RT Cen	Y Lup	R Nor	R CrB	RZ Sco
123459	*134236*	*145254*	*153849*	154428	*155823*
825 12.2 Pt	760 12.3 Bl	768 11.5 Bl	787 8.4 Bl	770 6.1 Ku	763 10.4 Sm
S UMa	788[13.0 Bl	774 11.9 Sm	X Lib	771 6.0 Ku	768 10.4 Ht
123961	R CVn	788 12.4 Bl	*153020*	772 6.0 Ku	768 10.6 En
728 8.3 Ku	134440	S Aps	788[12.8 Bl	772 6.3 Kd	774 10.6 Sm
732 8.3 Ku	825 8.4 Pt	*145071*	W Lib	774 6.1 Ku	775 11.2 Ht
751 8.7 Ku	RX Cen	760 9.9 Bl	*153215*	778 6.0 Kd	785 11.6 En
756 8.8 Ku	*134536*	762 9.9 En	788[12.5 Bl	779 6.0 Ku	787 11.7 Ht
759 8.8 Ku	760 11.2 Bl	763 10.1 Sm	S UMi	781 5.9 Ku	Z Sco
762 8.9 Ku	768 11.2 Bl	774 10.4 Sm	153378	783 6.1 Ch	*160021*
763 8.9 Ku	787 12.6 Bl	775 9.8 En	815 9.4 Pt	785 6.2 Kd	760 10.2 Bl
770 9.1 Ku	T Aps	768 10.4 Bl	U Lib	786 6.0 Ku	762 10.3 En
772 9.2 Ku	*134677*	768 9.9 En	*153620a*	787 5.5 Ku	763 10.3 Ht
789 9.8 Ku	746[13.2 Sm	781 10.2 En	788[12.4 Bl	788 5.9 Ku	764 10.1 Sm
791 10.3 L	788[13.2 Bl	787 9.9 Bl	T Nor	789 5.9 Ku	768 10.6 En
794 10.6 Kl	RU Hya	789 9.9 En	*153654*	791 6.1 Kd	768 10.3 Ht
795 10.6 Kl	*140528*	S Ser	763 10.0 Sm	791 6.1 L	774 9.9 Sm
799 10.8 Kl	763[12.9 Sm	151714	763 10.5 Ht	793 6.0 L	775 10.1 Ht
803 10.5 L	788[11.8 Bl	792 8.2 L	774 10.9 Sm	793 6.0 Be	777 9.5 Bl
812 11.0 Kl	R Cen	803 8.5 L	775 11.1 Ht	794 6.1 L	782 10.2 En
825 11.5 Pt	*140950*	815 9.1 Pt	778 10.8 Ht	796 6.1 L	787 10.3 Ht
RU Vir	762 7.6 En	816 8.9 L	787 11.4 Ht	796 6.0 Be	787 10.3 Bl
124204	763 7.3 Ht	S CrB	Z Lib	796 6.1 Ch	789 9.9 Bl
825 12.3 Pt	764 7.3 Sm	151731	*154020*	800 6.2 Hy	789 10.1 En
U Vir	768 7.5 En	799 9.2 Ch	789[12.7 Bl	800 6.2 Em	R Her
124606	768 7.1 Ht	815 8.1 Pt	R CrB	801 6.2 Kd	160118
825 12.5 Pt	768 7.0 Bl	817 7.6 Ms	154428	803 6.0 Be	799 9 8 Ch
U Oct	774 6.8 Sm	825 7.6 Ms	668 6.0 Ku	803 6.1 L	815 10.5 Pt
131283	775 7.3 En	826 7.5 Ms	669 5.9 Ku	805 6.1 L	U Ser
763[12.9 Ht	775 6.8 Ht	831 7.4 Ms	670 5.9 Ku	805 6.2 Kd	160210
788[13.6 Bl	781 7.1 En	832 7.4 Ms	671 6.1 Ku	806 6.1 L	815 12.2 Pt
R Hya	785 6.0 En	835 7.3 Ms	672 5.9 Ku	808 6.0 Bx	X Sco
132422	787 6.0 Bl	RS Lib	673 6.0 Ku	811 6.1 Pt	*160221a*
729 4.9 Kd	787 6.1 Ht	*151822*	674 6.1 Ku	813 6.2 Kl	760 12.9 Bl
741 5.1 Kd	789 5.9 En	760 8.7 Bl	675 6.0 Ku	815 6.0 L	SZ Her
760 5.7 Bl	U UMi	762 9.6 En	686 5.9 Ku	815 5.6 Bx	160325
762 6.0 En	141567	763 9.5 En	707 5.9 Ku	815 6.1 Pt	791 8.0 L
763 5.6 Sm	801 8.8 Ch	764 9.7 Sm	713 5.8 Ku	817 6.0 Ms	803 8.8 L
768 7.0 Bl	815 7.9 Pt	768 9.2 Bl	714 5.8 Ku	820 6.2 Pt	803 8 8 Be
768 6.1 En	S Boo	768 9.8 En	715 5 8 Ku	821 5.9 Ms	811 8.6 Pt
787 6.6 Bl	141954	768 9.8 Ht	717 6.0 Ku	822 6.0 Ms	815 9.2 Pt
S Vir	791 13.6 L	774 10.2 Sm	718 6.0 Ku	824 5.9 Ms	815 9.1 L
132706	815 13.0 Pt	775 10.2 Ht	719 5.9 Ku	824 6 1 Pt	820 9.3 Pt
763 9.4 Sm	816 12.6 L	776 10.2 En	722 5.8 Ku	825 6.1 Pt	825 9.4 Pt
RV Cen	V Boo	782 10.2 En	726 5.9 Ku	826 5.9 Ms	826 9.4 Pt
133155	142539a	787 10.4 Bl	728 5.9 Ku	826 6.1 Pt	827 9.4 Pt
760 8.9 Bl	793 8.6 L	787 10.2 Ht	729 6.0 Kd	827 6.1 Pt	831 9.3 Pt
768 8.8 Bl	803 9.2 Be	789 10.4 En	732 6.1 Ku	830 6.1 Pt	W Sco
787 8.6 Bl	803 9.0 L	RU Lib	741 6.0 Kd	830 6.2 Ms	*160519*
T Cen	815 9.0 Pt	*152714*	742 6.0 Ku	831 5.8 Ms	789 11.5 Bl
133633	R Cam	792 8.1 L	739 6.0 Ku	831 6.1 Pt	RU Her
760 7.0 Bl	142584	R Nor	751 5.7 Ku	832 5.8 Ms	160625
762 6.8 Ht	812 8.8 B	*153849*	754 6.0 Kd	835 6.1 Ms	791 14.3 L
763 7.2 En	821 8.2 Lp	760 8.0 Bl	756 6.0 Kd	837 6.1 Ms	815 13.6 L
763 6.5 Sm	R Boo	762 8.4 En	756 5.7 Ku	V CrB	R Sco
768 6.2 Bl	143227	764 7.5 Sm	759 5.8 Ku	154639	*161122a*
768 6.8 En	815 7.5 Pt	768 8.0 Bl	762 5.9 Ku	815 6.7 Pt	746 13.6 Bf
768 6.2 Ht	Y Lup	768 8.9 En	763 5.9 Ku	RZ Sco	756 11.5 Bf
774 6.0 Sm	*145254*	774 8.5 Sm	763 6.0 Kd	*155823*	760 11.5 Bl
775 5.9 Ht	760 11.8 Bl	782 9.0 En	766 6.1 Ku	762 10.2 En	763 11.5 Ht
787 5.8 Bl	768 11.5 Bl	786 9.1 En	767 6.3 Kd	763 10.2 Ht	764 11.5 Sm

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1926—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R Sco	SS HER	RR Sco	W PAV	T HER	R SCT
161122a	162807	*165030*	*174162*	180531	*184205*
765 11.8 Bg	793 11.8 L	762 6.4 Kd	787 11.2 Ht	821 7.8 Lp	672 5.6 Ku
765 11.3 En	803 10.6 L	763 6.3 Kd	789 11.1 Bl	821 8.0 Hu	675 5.5 Ku
768 11.0 Ht	815 10.6 Pt	767 6.3 Kd	789 10.4 En	832 7.5 Bx	680 5.4 Ku
768 11.0 Bl	816 10.2 L	769 5.7 Bl	RS OPH	W DRA	686 4.9 Ku
768 11.5 En	S OPH	778 6.4 Kd	174406	180565	714 6,2 Ku
774 10.7 Sm	*162816*	785 6.3 Kd	815 11.1 Pt	815 10.4 Pt	717 6.5 Ku
780 10.8 Bf	769 9.7 Bl	788 6.2 Bl	U ARA	815 10.7 Ie	719 6.7 Ku
782 10.6 Bf	780 9.4 Bl	791 6.5 Kd	*174551*	819 10.4 Lv	722 6.6 Ku
785 11.5 En	788 11.1 Bl	792 6.4 Kd	764 7.8 Sm	824 10.7 Bi	726 6.7 Ku
787 11.5 Ht	793 11.2 L	801 6.9 Kd	765 8.0 En	X DRA	728 6.7 Ku
788 10.9 Bl	W HER	RV HER	768 7.9 En	180666	729 6.6 Kd
S Sco	163137	165631	774 8.2 Sm	815 12.5 Ie	732 6.9 Ku
161122b	799 11.6 Ch	815 10.5 Pt	783 8.6 En	819 12.9 Lv	735 6.8 Kd
739 11.4 Bf	815 10.8 Pt	RT Sco	789 8.6 En	824 12.9 Bi	738 7.3 Kd
746 10.9 Bf	R UMI	*165636*	RT OPH	TV HER	741 7.0 Kd
756 11.2 Bf	163172	789 13.0 Bl	175511	181031	742 7.3 Ku
760 11.7 Bl	812 9.5 B	RT HER	815 11.2 Pt	793 12.5 L	742 7.0 Kd
763 11.9 Ht	821 9.4 Lp	170627	T DRA	803 10.8 L	746 7.4 Ku
764 11.9 Sm	R DRA	815 8.5 Pt	175458a	815 9.4 L	748 7.4 Ku
765 12.3 En	163266	RW Sco	812 12.9 B	RY OPH	751 7.3 Ku
765 11.7 Bg	800 9.2 Ch	*170833*	UY DRA	181103	754 6.6 Kd
768 11.5 Ht	807 8.9 B	760 11.2 Bl	175458b	815 12.9 Pt	755 6.6 Kd
768 12.0 Bl	815 8.0 Pt	769 11.1 Bl	812 10.9 B	W LYR	756 7.0 Ku
780 12.4 Bf	821 7.7 Lp	788 11.3 Bl	RY HER	181136	759 6.7 Ku
782 12.7 Bf	RR OPH	Z OPH	175519	794 8.1 L	762 6.4 Ku
787 12.2 Ht	*164319*	171401	810 11.1 Ie	806 8.0 L	762 5.9 Kd
802 12.5 Bf	764 8.5 Sm	799 9.8 Lg	815 10.8 Pt	815 8.0 Pt	763 6.4 Ku
W OPH	765 9.0 En	815 8.5 Pt	R PAV	815 8.3 Jo	764 5.9 Kd
161607	765 9.6 Bg	RS HER	*180363*	821 8.3 Hu	766 6.1 Ku
791 10.1 L	768 9.2 En	171723	762 8.1 En	824 9.0 Jo	767 5.4 Kd
799 10.5 Ch	774 8.8 Sm	815 12.6 Pt	763 8.4 Sm	RV SGR	770 5.7 Ku
803 10.7 L	782 9.6 Bf	S OCT	763 8.2 Ht	*182133*	771 5.7 Ku
816 11.3 L	785 9.3 En	*172486*	768 8.0 Ht	760 12.0 Bl	772 5.9 Ku
V OPH	792 10.2 L	761 11.6 Bl	768 7.8 En	769 11.2 Bl	772 5.4 Kd
162112	802 10.5 Bf	763 12.0 Ht	774 7.8 Sm	788 10.6 Bl	774 5.6 Ku
815 7.2 Pt	806 10.6 Bf	763 12.4 Sm	775 8.0 Ht	SV HER	778 5.0 Kd
U HER	806 10.6 L	768 12.1 Ht	782 8.0 En	182224	779 5.5 Ku
162119	813 10.8 Bf	769 12.1 Bl	787 8.3 Ht	793 13.9 L	783 5.2 Be
707 7.2 Ku	S HER	787 12.4 Ht	789 8.2 En	815 12.3 Pt	787 5.4 Ku
711 7.1 Ku	164715	789 12.3 Bl	T HER	816 12.4 L	785 5.4 Kd
713 7.1 Ku	815 11.8 Pt	RU OPH	180531	T SER	786 5.4 Kd
714 7.1 Ku	RS Sco	172809	714 8.5 Ku	182306	788 5.4 Ku
715 7.1 Ku	*164844*	815 11.3 Pt	715 8.5 Ku	815 10.3 Pt	791 5.0 L
717 7.2 Ku	763 12.0 Ht	RT SER	717 8.6 Ku	X OPH	791 5.4 Kd
719 7.2 Ku	764 11.5 Sm	*173212*	717 8.7 Ku	183308	793 5.2 Be
721 7.2 Ku	765 12.2 En	794 10.7 L	719 8.8 Ku	793 7.1 Be	795 5.2 L
721 7.2 Ku	768 12.0 Ht	RU Sco	722 9.5 Ku	793 7.0 L	796 5.2 Be
722 7.3 Ku	768 12.2 En	*173543*	726 9.7 Ku	803 6.9 L	796 5.2 Cb
726 7.5 Ku	774 11.5 Sm	760 9.5 Bl	732 9.6 Ku	815 7.0 Jo	797 5.8 Ch
728 7.6 Ku	783 11.8 En	769 8.9 Bl	742 10.1 Ku	815 6.3 Pt	798 5.8 Em
732 7.7 Ku	784 11.4 En	788 8.8 Bl	759 10.5 Ku	824 6.7 Jo	798 5.6 Hy
751 8.3 Ku	787 11.6 Ht	SV Sco	762 10.9 Ku	LV LYR	799 5.9 Lg
759 8.6 Ku	789 11.2 Bl	*174135*	770 11.0 Ku	184134	800 4.9 Lg
762 8.7 Ku	RR Sco	760 9.9 Bl	772 11.0 Ku	815 10.0 Ie	801 5.8 Kd
766 8.7 Ku	*165030*	769 10.4 Bl	785 11.6 Ch	815 10.0 Pt	803 5.7 L
770 8.6 Ku	729 7.4 Kd	788 10.8 Bl	787 11.2 Ku	826 10.2 Wa	804 5.2 Cb
783 9.2 Ch	739 7.3 Kd	W PAV	788 11.3 Ku	R SCT	805 4.8 Lg
787 9.0 Ku	741 7.2 Kd	*174162*	793 11.2 L	*184205*	805 5.8 Kd
812 9.8 B	754 6.8 Kd	764 13.0 Sm	803 9.5 L	670 5.3 Ku	806 4.9 Lg
815 9.4 Pt	760 5.8 Bl	785 10.9 En	815 8.6 Pt	671 5.4 Ku	807 5.0 Lg

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1926—Continued.

J.D.	Est.	Obs.
R Sct		
184205		
808	5.7	Ie
809	5.1	Lg
810	5.6	Pt
811	5.7	Pt
813	5.0	Lg
814	5.2	Lg
814	5.9	Kd
815	5.4	Lg
815	6.0	Pt
815	5.2	Jo
815	5.4	L
816	5.4	Lg
816	6.0	Pt
817	5.4	Lg
817	5.8	Ms
820	5.4	Cb
820	5.7	Pt
821	5.8	Ms
821	5.9	Pt
821	5.6	Ie
822	5.6	Lg
822	5.8	Ms
824	5.7	Ms
824	5.4	Jo
824	5.5	Pt
825	5.7	Ms
825	5.6	Pt
826	5.4	Pt
826	5.8	Ms
827	5.4	Pt
827	5.1	Cb
828	5.5	Pi
830	5.5	Ms
831	5.5	Ms
831	5.3	Pt
832	5.4	Ms
835	5.3	Ms
837	5.4	Ms
Nov. Aql		
184300		
815	11.0	Pt
820	10.8	Pt
821	10.7	Ie
824	10.7	Pt
831	10.6	Pt
S CrA		
185437a		
760	12.5	Bl
769	13 0	Bl
788	11.9	Bl
ST Sgr		
185512a		
796[	14.0	L
R CrA		
185537a		
760	12 8	Bl
769	13.0	Bl
788	11.7	Bl
T CrA		
185537b		
789[	13.0	Bl
Z Lyr		
185634		
807	12.0	B
815	11.5	Pt
R Aql		
190108		
783	5.7	Ch
797	5.8	Ch
815	6.1	Pt
821	6.9	Lp
RX Sgr		
190818		
783	9.4	Ch
800	9.4	Ch
815	9.7	Pt
RW Sgr		
190819a		
783	9.6	Ch
800	9.9	Ch
815	11.0	Pt
TY Aql		
190907		
815	10.6	Pt
S Lyr		
190925		
819[	13.8	Lv
X Lyr		
190926		
815	9.0	Pt
RS Lyr		
190933a		
819	12.6	Lv
RU Lyr		
191941		
815	11.0	Pt
815	11.2	Ie
U Dra		
191967		
815	13.5	Pt
W Aql		
191007		
815	11.0	Pt
T Sgr		
191017		
783	9.2	Ch
800	9.9	Ch
815	10.1	Pt
R Sgr		
191019		
783	9.8	Ch
800	8.2	Ch
815	7.1	Pt
RY Sgr		
191033		
729	7.1	Kd
755	7.1	Kd
760	7.0	Be
RY Sgr		
762	7.0	Bl
763	7.3	Kd
763	6.9	Ht
765	7.1	En
766	7.0	Bl
768	7.1	Ht
769	7.1	Bl
769	7.2	En
774	7.0	Sm
777	6.5	Bl
783	6.3	En
787	6.5	Ht
788	6.3	Bl
789	6.3	En
794	6.4	L
794	6.3	Bl
800	6.5	Ch
806	6.6	L
811	6.6	Pt
815	6.5	Pt
816	6.3	L
820	6.5	Pt
821	6.5	Pt
825	6.6	Pt
826	6.6	Pt
827	6.5	Pt
831	6.6	Pt
TY Sgr		
191124		
760	10.2	Bl
769	10.1	Bl
788	10.1	Bl
S Sgr		
191319a		
760	11.1	Bl
769	10.9	Bl
788	10.1	Bl
815	11.5	Pt
SW Sgr		
191331		
760	10.0	Bl
769	10.4	Bl
788	10.6	Bl
TZ Cyg		
191350		
815	10.6	Pt
U Lyr		
191637		
815	9.0	Pt
TY Cyg		
192928		
788	11.1	Ch
815	12.0	Pt
R Cyg		
193449		
800	12.3	Fm
800	12.2	Hy
807	11.2	B
R Cyg		
193449		
815	11.0	Jo
815	10.5	Pt
821	10.2	Hu
824	9.9	Bi
824	10.4	Jo
826	9.9	Ms
827	9.9	Gs
828	10.2	O
831	9.9	Jo
832	9.6	Ms
835	9.2	Ms
TT Cyg		
193732		
821	7.5	Hu
T Pav		
193972		
760	8.2	Bl
763	8.0	Sm
763	8.2	Ht
768	8.0	Ht
774	8.0	Sm
775	8.2	Ht
777	8.2	Bl
787	8.4	Ht
788	8.7	Bl
789	8.7	En
RT Cyg		
194048		
785	9.0	Ch
799	8.0	Ch
807	8.0	B
814	8 2	Jo
815	8.0	Pt
817	8.4	Gb
819	8.2	Lv
821	8.0	Hu
824	8.4	Bi
824	8.0	Jo
826	8.4	Ms
826	8.4	Wa
828	8.6	O
830	8.4	Ms
831	8.3	Jo
835	8.6	Ms
TU Cyg		
194348		
785	9.6	Ch
799	9.6	Ch
807	9.9	B
815	10.4	Pt
819	10.3	Lv
821	10.6	Hu
824	10.3	Bi
X Aql		
194604		
815	12.3	Pt
χ Cyg		
194632		
793	13.2	L
815	12.5	Pt
821	12.2	Lp
RR Sgr		
194929		
729	6.5	Kd
741	6.4	Kd
754	6.3	Kd
755	6.3	Kd
760	6.4	Bl
764	6.4	Kd
767	6.6	Kd
777	6.4	Bl
785	7.0	Kd
786	7.3	Kd
788	7.0	Bl
791	7.4	Kd
RU Sgr		
195142		
765[	12.5	En
787[	12.5	Ht
789[	13.2	Bl
RR Aql		
195203		
807	10.6	B
815	11.3	Pt
Nov. Cyg		
195553		
820	13 1	Pt
Z Cyg		
195849		
799	9.2	Ch
815	9.4	Pt
824	9.5	Jo
827	9.7	Jo
831	10.0	Jo
837	10.4	Pi
S Tel		
195855		
789[	12.6	Bl
SY Aql		
200212		
791	13.8	L
815	13.5	Pt
816[	13.6	L
S Cyg		
200357		
807	13.3	B
815	13.2	Pt
824	14.0	Bi
R Cap		
200514		
815	11.5	Pt
S Aql		
200715a		
800	9.2	Ch
807	9.5	Lg
809	9.5	Lg
S Aql		
200715a		
812	9.2	B
813	9.4	Lg
814	9.4	Lg
815	9.4	Lg
815	9.3	Pt
816	9.4	Lg
817	9.4	Lg
821	9.5	Lp
822	9.5	Lg
RW Aql		
200715b		
807	8.7	Lg
809	8.8	Lg
812	9.2	B
813	8.8	Lg
814	8.9	Lg
815	8.8	Lg
815	9.2	Pt
816	8.9	Lg
817	8.9	Lg
822	9.0	Lg
828	9.4	O
R Tel		
200747		
789[	13.0	Bl
W Cap		
200822		
789[	12.8	Bl
Z Aql		
200906		
815	10.4	Pt
828	9.0	O
R Sge		
200916		
812	9 1	B
RS Cyg		
200938		
785	7.3	Ch
788	7.5	Ch
794	7.6	L
797	7.5	Ch
799	7.5	Ch
800	7.5	Ch
803	7.5	L
804	7.6	Ch
805	7.6	Ch
808	7.5	Ch
815	7.5	Jo
815	7.3	Pt
817	7.8	Gb
824	8.0	Jo
831	8.1	Jo
837	8.8	Pi
R Del		
201008		
794	12.4	L
815	13.5	Pt
816	13.4	L

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1926—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RT CYG	ST CYG	S IND	T CEP	W CYG	R GRU
201121	202954	*204954*	210868	213244	*214247*
729 7.8 Kd	815 10.4 Pt	762[13.5 Bl	759 6.4 Ku	742 5.9 Ku	788 11.5 Bl
764 7.5 Kd	821 10.7 Ie	789[13.5 Bl	760 6.4 Vv	746 6.0 Ku	V PEG
785 7.6 Kd	824 10.6 Bi	X DEL	762 6.2 Vv	748 6.1 Ku	215605
815 6.6 Pt	831 10.1 Ya	205017	762 6.3 Ku	749 6.1 Ku	825 10.7 Pt
SX CYG	837 11.0 Pi	824 13.7 Lv	763 6.3 Ku	751 6.1 Ku	825 10.4 Lv
201130	R MIC	830[13.5 Lv	765 6.3 Vv	754 6.4 Kd	U AQR
815 9.9 Pt	*203429*	R VUL	770 6.4 Ku	756 6.4 Kd	*215717*
RT SGR	761 9.5 Bl	205923	771 6.5 Ku	756 6.4 Ku	825 11.7 Pt
201139	777 11.1 Bl	800 9.4 Ch	772 6.5 Ku	757 6.4 Ku	RT PEG
761 11.0 Bl	788 12.4 Bl	803 9.3 Ch	774 6.6 Ku	759 6.3 Ku	215934
777 11.5 Bl	S DEL	806 7.8 Lv	779 6.7 Ku	762 6.2 Ku	824 11.4 Lv
788 12.5 Bl	203816	815 8.4 Jo	783 6.8 Ch	762 6.4 Kd	825 11.3 Pt
WX CYG	815 9.1 Pt	817 8.5 Jo	787 7.0 Ku	763 6.4 Kd	RY PEG
201437b	V CYG	820 8.2 Pt	788 7.3 Ku	763 6.5 Ku	220133a
799 10.8 Ch	203847	821 8.6 Ie	791 6.5 L	766 6.4 Ku	825 11.8 Pt
815 10.4 Jo	815 12.6 Pt	821 8.8 Hu	799 6.9 Ch	767 6.4 Kd	RZ PEG
815 9.5 Pt	824 13.1 Bi	824 8.5 Lv	803 7.0 Ch	770 6.2 Ku	220133b
817 11.0 Gb	Y AQR	825 7.9 Jo	805 7.2 Ch	771 6.2 Ku	825 10.9 Pt
819 11.1 Lv	*203905*	V CAP	805 6.7 L	772 6.6 Kd	831 11.7 Pi
824 10.0 Jo	800 10.6 Ch	*210124*	815 7.1 Jo	778 6.5 Kd	Y PEG
831 10.3 Jo	813 10.9 Lg	789[12.7 Bl	820 7.4 Pt	785 6.4 Kd	*220613*
837 11.0 Pi	814 10.9 Lg	TW CYG	824 7.4 Jo	788 6.5 Kd	825 11.2 Pt
U CYG	815 10.9 Lg	210129	825 8.0 Hu	791 6.6 Kd	831 10.6 Pi
201647	816 10.9 Lg	821 10.4 Ie	831 7.8 Jo	799 6.5 Kd	RS PEG
785 10.8 Ch	816 11.1 Pt	X CAP	RR AQR	801 6.5 Kd	220714
799 10.6 Ch	817 11.0 Lg	*210221*	*210903*	805 6.5 Kd	825 12.3 Pt
815 8.9 Jo	T DEL	761[12.7 Bl	820 11.8 Pt	815 6.6 Kd	T GRU
815 8.8 Pt	204016	789 11.5 Bl	X PEG	S CEP	*221938*
817 9.4 Gb	823 14.2 Ie	RS AQR	211614	213678	763 9.2 Sm
824 8.8 Jo	V AQR	*210504*	820 11.4 Pt	801 8.1 Ch	774 10.1 Sm
824 9.6 Lv	204102	793 10.3 L	T CAP	820 7.5 Pt	S GRU
826 9.6 Ms	816 9.4 Pt	803 10.4 L	*211615*	825 7.9 Hu	*221948*
831 8.6 Jo	W AQR	820 10.6 Pt	761 12.3 Bl	825 8.3 Lv	763[11.8 Sm
832 8.2 Ms	*204104*	Z CAP	789[12.7 Bl	829 8.7 Wa	768[12.8 Ht
835 8.1 Ms	793 13.4 L	*210516*	S MIC	RU CYG	785[12.8 En
837 9.0 Pi	816 13.7 L	820 13.0 Pt	*212030*	213753	S LAC
U MIC	U CAP	T CEP	761 11.4 Bl	800 7.8 Ch	222439
202240	*204215*	210868	764 10.3 Sm	825 7.5 Pt	806 11.7 Lv
760 11.9 Bl	761 12.3 Bl	683 7.3 Vv	774 9.7 Sm	828 8.4 Pi	817 10.8 Lv
777 10.2 Bl	789[13.1 Bl	706 6.3 Vv	777 9.7 Bl	RV CYG	825 10.7 Cl
788 9.0 Bl	T AQR	707 6.9 Vv	788 9.6 Bl	213937	825 10.3 Pt
Z DEL	*204405*	711 6.9 Vv	Y CAP	825 6.6 Pt	837 9.8 Pi
202817	794 8.8 Cb	726 6.4 Vv	*213814*	825 7.2 Hu	R IND
824 13.9 Lv	797 7.6 Ch	727 6.2 Vv	761[12.9 Bl	RR PEG	*222867*
SZ CYG	800 7.6 Ch	728 6.4 Vv	789[12.9 Bl	214024	761 11.6 Bl
202946	813 8.3 Lg	729 6.4 Vv	W CYG	825 13.5 Pt	789[13.5 Bl
810 9.0 Pt	814 8.3 Lg	730 6.6 Vv	213244	R GRU	T TUC
811 8.8 Pt	815 8.3 Lg	732 6.4 Vv	R GRU	*214247*	*223462*
815 9.0 Pt	816 8.3 Lg	734 6.3 Vv	714 6.2 Ku	761 10.2 Bl	763 12.7 Sm
816 9.1 Pt	817 8.3 Lg	736 6.2 Vv	717 6.0 Ku	762 10.1 En	763 12.8 Ht
820 9.4 Pt	820 8.1 Cb	737 6.2 Vv	718 6.0 Ku	763 9.9 Sm	765 12.0 En
821 9.5 Pt	821 8.5 Hu	740 6.3 Vv	719 6.0 Ku	763 10.3 Ht	768 12.3 En
824 9.2 Pt	RZ CYG	741 6.2 Vv	722 6.1 Ku	768 10.0 En	768 12.8 Ht
825 9.3 Pt	204846	742 6.2 Vv	726 6.0 Ku	768 10.3 Ht	785 12.8 En
826 9.0 Pt	816 11.6 Pt	743 6.1 Vv	728 6.1 Ku	774 10.1 Sm	R LAC
827 8.8 Pt	818 11.7 Lv	745 6.2 Vv	729 6.2 Kd	775 10.6 En	223841
831 8.8 Pt	821 11.5 Ie	754 6.1 Vv	732 6.1 Ku	775 10.3 Ht	806 12.2 Lv
836 9.5 Pt	824 11.1 Bi	755 6.4 Vv	735 6.4 Kd	777 10.1 Bl	817 12.8 Lv
	826 11.4 B	756 6.3 Ku	738 6.3 Kd	785 10.6 En	825 13.3 Pt
		757 6.4 Ku	741 6.5 Kd	787 11.4 Ht	
			742 6.4 Kd		

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1926—Continued.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RW PEG	W PEG	S PEG	ST AND	R AQR	R TUC
225914	231425	231508	233335	*233815*	*235265*
810 11.1 Bf	772 8.9 Ku	802 8.4 Ch	800 8.9 Lg	797 10.0 Ch	763[13.0 Sm
814 11.2 Bf	774 8.8 Ku	825 8.6 Pt	801 9.1 Ch	825 9.0 Ms	786[12.9 En
817 11.0 B	779 8.5 Ku	RY CEP	807 8.9 Lg	825 8.7 Pt	R CAS
818 11.0 Bf	781 8.5 Ku	231878	808 8.8 Lg	826 8.4 Ms	235350
825 10.9 Pt	784 8.6 Ku	801 9.4 Ch	809 8.9 Lg	833 9.0 Ms	801 9.3 Ch
829 10.9 Wa	787 8.5 Ku	V PHE	810 8.8 Lg	Z CAS	817 9.3 Lv
831 10.6 Pi	789 8.5 Ku	*232746*	813 8.8 Lg	233956	Z PEG
R PEG	794 8.4 Kl	763[13.2 Sm	814 8.8 Lg	817 13.7 Lv	235525
230110	795 8.4 Kl	787[12.7 Ht	815 8.7 Lg	RR CAS	820 9.1 Gs
823 12.3 Ie	799 8.5 Kl	Z AND	816 8.7 Lg	235053	825 9.0 Pt
825 12.2 Pt	802 8.0 Ch	232848	817 8.7 Lg	815 12.4 Ie	827 9.5 Gs
826 12.3 B	804 8.5 Kl	801 9.6 Ch	822 8.8 Lg	V CET	SV AND
V CAS	806 8.5 Kl	825 9.6 Pt	825 7.9 Hu	*235209*	235939
230759	817 8.8 Lv	ST AND	825 8.8 Pt	761 10.6 Bl	817 11.4 Lv
825 11.4 Pt	825 8.2 Hu	233335	837 9.8 Pi	777 11.3 Bl	825 10.2 Pt
	831 9.0 Pi	799 9.0 Lg		788 12.0 Bl	

RAPIDLY VARYING IRREGULAR VARIABLES.

Star J.D. Est.Obs.	J.D. Est.Obs.	Star J.D. Est.Obs.	J.D. Est.Obs.
005840 RX ANDROMEDAE—		213843 SS CYGNI—	
811.5 10.9 Pt	824.5[12.4 Pt	788.2 11.9 Ch	821.5 11.9 Ms
815.6[12.4 Pt	825.5[12.4 Pt	791.4 12.0 L	821.5 11.7 Ie
816.7[12.4 Pt	826.5[12.4 Pt	793.2 11.5 L	822.5 11.8 Ms
820.6[12.4 Pt	830.9 11.0 Pt	794.3 11.7 L	823.5 11.5 Ie
821.5[12.4 Pt	831.5 11.2 Pt	795.4 12.1 L	824.5 11.8 Ms
		796.3 11.5 L	824.5 11.5 Pt
060547 SS AURIGAE—		798.4 12.1 L	824.6 11.3 Lv
791.4 13.9 L	816.5 11.2 Bg	799.2 11.9 Ch	825.5 11.4 Ms
793.4[13.9 L	816.7 11.0 Pt	800.3 11.9 Ch	825.5 11.7 Pt
794.3[13.0 L	817.5 10.8 Bg	801.3 11.7 Ch	825.6 11.5 Cl
795.4[13.3 L	819.3 11.1 Bf	802.3 11.5 L	825.6 11.7 Pt
797.4[14.1 L	819.4 10.9 Bg	803.2 11.7 Ch	825.7 11.6 Hu
798.4[12.4 L	820.3 11.8 Bg	803.4 11.7 L	826.5 11.6 Ms
799.2[11.6 Ch	821.6 13.1 Ie	804.3 11.6 L	826.5 11.0 Wa
800.2[11.6 Ch	823.6[13.3 Ie	805.3 11.4 L	826.6 11.5 Cl
802.6[15.0 L	824.5[12.4 Pt	806.2 11.3 L	827.5 11.7 Pt
803.4[14.0 L	825.6[13.0 Cl	806.7 12.2 Lv	828.5 11.6 Pi
806.6 14.5 L	826.6[13.0 Cl	807.6 11.9 B	829.6 10.9 Wa
808.4[15.1 Bg	827.5[12.4 Pt	808.5 11.9 Ie	830.6 11.5 Lv
810.6[11.4 Ie	830.9[12.6 Pt	810.5 12.0 Ie	831.5 11.5 Pi
815.3[13.0 L	831.6[12.6 Ie	810.6 11.8 Pt	831.5 11.7 Pt
815.6[12.6 Ie	836.7[12.4 Pt	811.5 11.8 Pt	831.5 11.3 Ms
816.3 10.9 L		814.6 11.9 Wa	831.5 11.6 Ie
		815.3 12.1 L	831.6 11.2 Ya
074922 U GEMINORUM—		815.6 11.7 Pt	832.5 10.8 Ms
791.6[13.9 L	825.8[13.3 Pt	816.7 12.2 L	833.5 8.8 Ms
804.4[12.4 Ch	830.9[13.3 Pt	817.6 12.0 Cl	835.5 8.8 Ms
805.7[13.7 L	831.7[12.4 Pt	817.7 11.9 Lv	836.7 8.7 Pt
806.6 14.2 L		818.7 11.8 Lv	837.6 8.2 Pi
		819.6 11.6 Lv	837.6 8.4 Ie
		820.5 11.5 Pt	

Total observations, 1718; Total stars, 339; Total observers, 35.

an important part in our observing program. Mr. Crane had been a Life Member for many years, and at one time served as a member of the Council of the Association. For a short time he acted as Recording Secretary. Although never

enjoying very robust health, he evidenced a wide interest in the welfare of the Association, and many of the "Old Guard" members will recall the delightful and informal week-ends spent at Shawme Farm in Sandwich as Mr. Crane's guests.

The following observers have contributed to this report of observations received during the month of November: Allen, "Al"; Baldwin, "Bl"; Bappu, "Bf"; Barnes, "Bx"; Benini, "Be"; Berman, "Bi"; Bhaskaran, "Bg"; Bouton, "B"; Chandra, "Ch"; Cherrington, "Cb"; Clement, "Cl"; Elmer, "Em"; Ensor, "En"; Gaebler, "Gb"; Goodsell, "Gs"; Henry, "Hy"; Houghton, "Ht"; Hunter, "Hu"; Iedema, "Ie"; Jones, "Jo"; Kanda, "Kd"; Kohl, "Kl"; Kukarkin, "Ku"; Lacchini, "L"; Leavenworth, "Lv"; Lepper, "Lp"; Logan, "Lg"; Mrs. Morris, "Ms"; Olcott, "O"; Peltier, "Pt"; Pickering, "Pi"; Smith, "Sm"; Vorontsov-Velyaminov, "Vv"; Watson, "Wa"; Yalden, "Ya".

LEON CAMPBELL, Recording Secretary.

December 6, 1926.

ANNUAL REPORT OF THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS FOR 1926.

Observer	Initial	January	February	March	April	May	June-July	Aug.-Sept.	October	November	December	Totals
Ancarani	An	..	..	..	..	..	..	..	42	14	..	56
Allen	Al	10	2	5	..	12	..	..	..	..	..	29
Baldwin	Bl	127	110	133	88	124	104	300	245	127	91	1449
Barnes	Bx	2	3	5	..	..	..	..	..	2	17	29
Benini	Be	..	..	..	..	..	..	10	28	15	10	63
Berman	Bi	37	13	25	8	9	25	11	28	19	..	175
Bouton	B	157	162	128	126	105	45	176	..	44	141	1084
Brown	Bn	..	..	..	..	..	..	..	12	8	10	30
Bunch	Bh	9	..	..	..	..	36	7	..	..	..	52
Chandra	Ch	105	223	178	162	226	175	312	139	83	82	1685
Chisolm	Cm	..	..	..	..	..	..	14	15	15	..	44
Clement	Cl	..	..	..	..	..	2	12	22	15	9	60
Cilley	Cy	..	212	58	87	45	74	71	137	57	..	741
Cunningham, A.B.	Ci	..	..	..	..	20	14	11	..	..	..	45
Cunningham, L.E.	Cu	61	4	53	79	61	..	84	51	33	..	426
Dunham	Du	67	23	6	..	..	..	..	..	..	..	96
Ensor	En	..	..	..	..	..	..	126	145	99	86	456
Gaebler	Gb	11	7	7	5	5	6	14	13	14	..	82
Goodsell	Gs	5	7	5	..	..	..	..	10	5	2	34
Hama	H	..	..	..	46	..	..	..	..	..	37	83
Hawes	Hs	..	..	..	..	18	11	17	..	..	..	46
Houghton	Ht	136	..	99	..	..	..	45	136	76	62	554
Hunter	Hu	12	23	..	..	..	..	..	..	..	20	55
Iedema	Ie	46	35	29	39	18	28	22	18	59	22	316
Ikeda	Ik	9	68	16	..	..	..	..	18	..	..	111
Johnstone	Jn	..	..	..	..	..	10	7	6	5	..	28
Jones	Jo	60	46	38	5	4	32	90	50	59	19	403
Kanda	Kd	29	47	65	..	50	..	44	..	79	..	314
Kasai	Kk	56	..	70	..	..	..	..	..	180	..	306
Kohl	Kl	38	68	14	43	11	26	16	5	42	40	303
Kukarin	Ku	..	..	..	..	..	..	..	45	..	..	45
Koelbloed	Kb	..	40	..	..	..	..	27	..	..	..	67
Lacchini	L	116	66	69	59	41	76	150	196	129	142	1044

ANNUAL REPORT—Continued.

Observer	Initial	January	February	March	April	May	June-July	Aug.-Sept.	October	November	December	Totals
Lytle	Ly	45	15	12	..	..	..	..	..	..	..	72
Leavenworth	Lv	..	10	2	19	14	39	48	35	4	32	203
Leavens	Ls	..	..	17	..	..	..	12	..	..	..	29
Lepper	Lp	..	17	19	..	23	..	..	28	18	45	150
Logan	Lg	..	..	..	..	..	..	..	..	..	50	50
Millman	Mm	..	6	..	..	..	..	..	24	..	..	30
Marshall	Mh	..	..	10	..	1	4	..	..	..	11	26
Murdoch	Mb	..	6	..	7	2	..	11	..	..	..	26
Nakamura	Nk	..	..	172	..	..	..	..	..	..	158	330
Olcott	O	37	..	..	..	..	..	16	..	11	37	101
Paranego	Pg	..	..	..	..	64	..	..	9	..	..	73
Peltier	Pt	305	230	224	259	206	259	540	368	410	305	3106
Proctor	Pc	..	..	..	2	..	12	12	30	96	25	177
Rhorer	Ro	5	..	..	..	..	..	16	19	9	..	49
Skaggs	Sg	..	..	..	11	16	20	..	38	19	14	118
Smith	Sm	156	..	149	96	..	85	81	158	110	113	948
Tchernov	Tc	..	..	..	..	34	..	..	24	..	..	58
Turk	Tu	..	..	..	..	22	..	..	..	..	..	22
Vorontsov-Vel.	Vv	..	..	..	..	124	..	..	35	..	..	159
Watson	Pw	..	..	5	..	10	28	..	20	35	12	110
Waterfield	Wf	251	61	..	68	159	237	343	336	..	..	1550
White	Wb	12	..	11	..	..	..	..	17	14	..	54
Yalden	Ya	..	..	15	..	..	..	39	..	10	15	79
18 Others		2	22	25	9	20	19	25	20	10	22	174
Total observations		1906	1606	1664	1218	1444	1367	2709	2522	1925	1629	17990
Observers per month		32	26	33	20	30	25	39	36	35	29	74
Stars per month		363	334	343	326	314	313	376	324	332	336	434

SUMMARY OF ANNUAL REPORTS.

Year	Observations	Stars	Observers
1912	6,180	175	19
1913	12,914	200	20
1914	14,506	255	28
1915	14,724	282	29
1916	11,261	290	30
1917	15,788	332	43
1918	16,112	380	34
1919	8,710	352	53
1920	9,099	395	69
1921	15,513	386	77
1922	16,994	372	72
1923	17,745	441	68
1924	19,484	450	70
1925	23,375	439	68
1926	17,990	434	74
Totals	219,395	460	300*

*Approximate number of observers in all the published reports of the A.A.V.S.O.

LEON CAMPBELL, Recording Secretary.

November, 1926.

COMMUNICATIONS.

Betelgeuse.—I would like to call the attention of variable star observers to Betelgeuse (α Orionis) which I am sure is down much below normal. Last night (Dec. 8) and on several previous nights it was *less* than one-tenth of a magnitude brighter than Aldebaran, and far inferior to Rigel. It would be interesting to get its diameter now with the interferometer at Mount Wilson.

Boston, Dec. 9, 1926. FRANK E. SEAGRAVE.

The Neighbors.—I was surprised to read in a recent number of "Science" (November 19, 1926) that an Association of Professional Astronomers had been founded in 1921, and that the paternity of this organization was imputed to me. There is, in fact, no such association nor any need of one. Upon inquiry, the Editor of "Science" states that the item was taken from a New York newspaper and he regrets that it was printed in "Science" without being verified.

There is, however, a gleam of truth in the item, and I write this note principally to describe briefly a plan that some astronomers on the Atlantic coast have been carrying out since 1920; this has proved so useful that possibly other groups (in other localities or in other sciences) may wish to make the same experiment. Beginning in June, 1920, a number of us whose chief interest is research have been meeting informally about four times a year for the purpose of exchanging ideas and getting the benefit of the collective wisdom and experience of the whole group in the solution of our individual problems. But it is of the essence of this idea that there should be no organization; there is no constitution, no rules of any kind, no officers, no fixed list of members, and no dues! We have even lacked a name until very recently, when we have begun to call ourselves the Neighbors. At first we met in New York City, but this was found to be unnecessarily expensive, and for some of the members it was somewhat inconvenient. We now meet at New Haven because it is centrally located, because a good astronomical library is at hand, and because the courtesies extended to us by two clubs in the city make the meetings much more pleasant than they could be in a busy metropolitan hotel. These meetings begin on Friday afternoon and break up somewhat gradually, most of the out-of-town members leaving on Saturday, a few sometimes remaining over until Sunday. We spend all this time together except the few hours that must be wasted in sleep. It is understood that no one is to attempt to read a paper, but during this day or two there is much astronomy in the air; some of it is very much so, for it has gotten to be a tradition with us that our statements need not be well considered. Many a fascinating theory has seen the light of day, flourished, and passed on, all in the space of twenty minutes.

In a small group like this, meeting so frequently, our knowledge of each other has gotten to be intimate and has given rise to a network of friendships, which in themselves, aside from any questions of scientific results, justify the existence of the Neighbors.

FRANK SCHLESINGER.

Yale University Observatory, December 20, 1926.

GENERAL NOTES.

Dr. W. J. Humphreys, of the U. S. Weather Bureau, gave an illustrated lecture on "Fogs and Clouds" at St. John's College, Annapolis, on November 23. (*Science*, December 3, 1926.)

The Honorable Charles Evans Hughes, formerly secretary of state, has accepted the appointment of honorary president of the American Association for Medical Progress, succeeding the late Dr. Charles W. Eliot. (*Science,* December 3, 1926.)

Prof. E. P. Lewis, head of the Department of Physics in the University of California, and a member of the Board of Directors of the Astronomical Society of the Pacific, died on November 17, 1926. (*Publications of the Astronomical Society of the Pacific,* December, 1926.)

Miss Mary Proctor, F. R. A. S. has made arrangements to observe the coming total eclipse of the sun, June 29, 1927, at Darlington, York, England. If anyone wishes to join her party, she will be pleased to hear from them and make necessary managements regarding accommodation. Address 35, St. George's Square, London, S.W.1.

Dr. Charles G. Abbot, director of the Astrophysical Observatory, Smithsonian Institution, gave an address on "The Smithsonian Institution" at the Boston Public Library on November 18, and addresses entitled "The Life of Research" and "The Study of Solar Radiation" at the Massachusetts Institute of Technology on November 19 and 22. (*Science,* December 3, 1926.)

Dr. William E. Ritter, President of "Science Service," former Director of the Scripps Institution for Oceanography at La Jolla, California, and Emeritus Professor of zoology at the University of California, and Mrs. Ritter were guests of honor at a dinner at the Cosmos Club in Washington recently on the occasion of Dr. Ritter's seventieth birthday. The comprehensive work of Dr. Ritter was reviewed at this time by several scientists and educators.

Dr. W. W. Campbell Honored. —Decorated for the third time by the French, President W. W. Campbell of the University of California, yesterday received the Cross of Office of the Legion of Honor, bestowed upon him by President Gaston Doumergue. Accompanying the decoration, which the president received through the mail, was a formal statement explaining that it had been recommended by Aristide Briand, Minister of Foreign Affairs. The letter was signed by H. G. Heilmann, French Consul-General in San Francisco. President Campbell has previously received two gold medals from the Paris Academy of Science, of which he is a member. These were given in recognition of his contributions to science in his astronomical studies and research. The president is also a member of the French Bureau of Longitudes.—(*San Francisco Chronicle,* October 16, 1926.)

The Rumford Medal of the Royal Society.—The following award has been made by the Royal Society: The Rumford Medal to Sir Arthur Schuster, F.R.S., for his services to physical science, especially in the subjects of optics and terrestrial magnetism. (*Science,* December 3, 1926.)

The Faculty of Science of the Imperial University of Tokyo has begun publication of a separate section (Section I) of its *Journal,* to be devoted to mathematics, astronomy, physics, and chemistry. (*Bulletin of the American Mathematical Society,* September-October, 1926.)

"Silo" Proves to be An Astronomical Observatory. — An odd looking building resembling a silo was recently erected in Buffalo on top of a garage. Inquiry proved it to be a private astronomical observatory belonging to Dr. Charles W. Bullock, 23 Winston Road, Buffalo, an analytical chemist. Dr. Bullock was more interested in the stars than in automobiles, so he converted his garage into a study and outfitted it with magnifying equipment of the most modern and convenient type. The observatory was built with a sheet metal dome for the telescope much like the large official observatories. The dome is of a very unusual

Astronomical Observatory of Dr. Charles W. Bullock, Buffalo, New York, with a dome of sheet iron.

design. It was built of pure iron. The building was designed and built under the instruction of Dr. Bullock by Clarence Patterson, contractor. The "silo" mounts thirty feet in the air above the roof of the garage. This height permits pointing the telescope down to the horizon. The building is round and has a cone-shaped top. The interior diameter of the building is twelve feet.

The telescope, known as an equatorial telescope, was designed and mounted by the Bausch and Lomb Company of Rochester, N. Y. It is equipped with a clock-work that automatically keeps it directed toward any desired star or planet, offsetting the motion of the earth. The instrument is mounted on a concrete base

that reaches down to hard pan clay, thus making certain that it will be free from all disturbing vibrations.

Dr. Bullock also has in the garage a projection microscope which is so powerful that it will magnify an object 3000 diameters. It will magnify a fly's wing so that it appears eighteen feet long, and a fly's eye so that it appears six feet in diameter. Dr. Bullock finds a great deal of pleasure in studying astronomy as a hobby. He is a graduate in chemistry from the University of Buffalo and now conducts an analytical laboratory there. He says that the stars with their spectacular coloring as viewed through a powerful telescope are among the most beautiful sights that can be seen.

BOOK REVIEWS.

Aus den Tiefen des Raumes, by Dr. Friedrich Becker, (Ferd. Dümmlers Verlag, Berlin SW68. Price M 3.50).

This little book of 120 pages offers several hours of delightful reading to those who read German. It tells about the stars, star clusters and nebulae in a simple way that is exact and yet entertaining. The newest discoveries in the stellar world are considered. Anyone reading it will have a good review of modern astronomical thought. It can be recommended without reservation as a well-written popular account of the great universe outside the solar system.

Harmonic Curves, by William F. Rigge, S. J. (The Creighton University, Omaha, Nebraska, 1926). The purpose of the book is to give as complete as possible an account of the mode of generation and properties of a certain important class of curves called by the author "harmonic curves" for the reason that their equations involve sums of sine terms representing simple harmonic motions with different periods and phases. The book is divided into nine chapters followed by four appendices. After an introduction, explaining the general purpose of the work, the author gives in the first chapter the geometric definition of simple harmonic motion as well as its mechanical aspects. The second chapter deals with mathematics of harmonic curves and discusses in full detail the various forms of their equations. The third chapter has for its object the exposition of both the numerical and the graphic methods for plotting these curves. The fourth chapter gives a most interesting description of various machines designed to draw harmonic curves by continuous motion. Among these instruments the Creighton machine, invented by the author himself, deserves special attention for the reason that "in principle it will draw any form of harmonic curve" according to the author's statement. The fifth chapter is devoted to the study of epi- and hypocycloids, and the two subsequent chapters deal with the esthetical side of the subject, discussing the beauty of harmonic curves as well as stereoscopic pairs of such curves. The eighth chapter gives an account of harmonic analysis including the description of Henrici's analyzer. Finally, the last chapter presents various examples of harmonic curves. The four appendices reproduce the matter contained in the articles by the author published in the *American Mathematical Monthly*. The exposition throughout the book is clear and popular enough to be understood by the reader whose knowledge does not extend beyond elementary mathematics, and the whole project is treated so completely and from such various points of view that hardly anything remains to be desired. Numerous beautiful figpres enhance the interest of this book. J. U.